Fish Survey of Barkley Sound Streams, Vancouver Island

T. G. Brown, I. V. Williams, and B. C. Andersen

Department of Fisheries and Oceans
Fisheries Research Branch
Pacific Biological Station
Nanaimo, British Columbia V9R 5K6

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T. G. Brown, I. V. Williams, and B. C. Andersen

Department of Fisheries and Oceans

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Nanaimo, British Columbia V9R 5K6

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ABSTRACT

Brown, T. G., I. V. Williams, and B. C. Andersen. 1987. Fish survey of Barkley Sound streams, Vancouver Island. Can. MS Rep. Fish. Aquat. Sci. 1953: 61 p.

Minnow traps were used to capture juvenile salmonids from five locations in each of twenty-one Barkley Sound streams. At each location the environmental features were noted, the length and weight of all captured juvenile coho were recorded, and scales were obtained for salmonid age determination. Juvenile coho catch/effort, mean length of one year old coho, and percent two year olds were calculated for each stream surveyed. The mean catch at each location was correlated to various environmental features such as: dominant biogeoclimatic variant, gradient, stream order, stream orientation and stream location. The mean catch at each location was also correlated with vegetation type, vegetation age, percentage in-stream cover, cover type, and substrate type. Few results were statistically significant because catches and age compositions were highly variable and sample sizes were small.

RÉSUMÉ

Brown, T. G., I. V. Williams, and B. C. Andersen. 1987. Fish survey of Barkley Sound streams, Vancouver Island. Can. MS Rep. Fish. Aquat. Sci. 1953: 61 p.

Des pièges à ménés ont été utilisés pour capturer des salmonidés juvéniles en cinq endroits de 21 cours d'eau de détroit Barkley. Pour chaque endroit, on a noté les caractéristiques de l'environnement de même que la longueur et le poids de tous les cohos juvéniles capturés, et des écailles ont été prélevées pour la détermination de l'âge des salmonidés. Le rapport prises/effort pour les cohos juvéniles, la longueur moyenne des cohos agés d'un an et le pourcentage de cohos agés de deux ans ont été calculés pour chacun des cours d'eau. La prise moyenne de chaque endroit a été corrélée à diverses caractéristiques environnementales telles la variante géoclimatique dominante, le gradient, l'ordre, l'orientation et la position du cours d'eau. La prise moyenne de chaque endroit a aussi été corrélée au type et à l'âge de la végétation, au pourcentage de couverture du cours d'eau, au type de couverture et au type de substrat. Peu des résultats obtenus se sont avérés statistiquement significatifs car les prises et les compositions des âges étaient très variables et les échantillons petits.

PREFACE

This survey was conducted in-part, to support a data base of Barkley Sound Streams (Brown et al. in preparation). The data base contains a more detailed description of each stream's physical characteristics than does this report. Information obtained from the data base and used in this report includes: dominant biogeoclimatic varient, stream gradient, stream order, watershed orientation and location within Barkley Sound (see Figure 5). The logging history of each watershed was also obtained from Brown et al. (in preparation).

INTRODUCTION

There has been considerable speculation as to the applicability of findings from the **Carnation Creek Experimental Project** (Hartman 1982) to other watersheds. Each stream has unique features (physical nature and logging history) which ultimately dictate its capacity to produce coho salmon (*Oncorhynchus kisutch*). This survey was conducted in-part to examine the variability between streams in juvenile coho salmon numbers, age and length and to relate these variables with stream habitat characteristics. Carnation Creek's status relative to other streams, within the same general location (Barkley Sound, Vancouver Island) could then be examined.

This survey was also conducted in-part to gain specific on-site information which could support the Barkley Sound fish/forestry data base (Brown et al. in preparation). The data base was formed primarily from maps and reference material. During the course of this survey 23 of the 65 streams listed in the data base were visited and the validity of information checked.

This survey was viewed by its authors to be a precursor to a more detailed synoptic survey. The validity of procedures and techniques used in this survey were examined and insight into man-power, equipment and time requirements for estimating various physical and biological parameters from a variety of west coast streams was gained. The design of any synoptic survey conducted in the future should benefit greatly from this initial survey.

METHODS

Twenty-three streams in Barkley Sound were surveyed from March 19 to April 2, 1987 (Figure 1). Twenty-one of these streams were sampled for fish. Sechart Creek and Useless Creek were not sampled for fish because the accessible length was too short. An attempt was made to sample each stream within a main-channel section from 500 to 750m above salt-water influence. Those streams which could not be sampled at this location due to access problems or because the accessible length for anadromous fish was insufficient, were sampled in the most appropriate locations available.

Each stream was sampled for fish at five separate sites with six minnow traps per location. The minnow trapping procedure was as described by Brown (1985). Traps were baited with a spoonful of canned herring held within a perforated plastic bag. All traps were placed in locations most likely to contain rearing salmonids and were left for 24 hours to attract fish.

A description of the general habitat characteristics (riparian and in-stream) and a measure of the site's dimensions (used to calculate area and volume of pools in which traps were placed) was recorded at each of the five sites for each of the watersheds surveyed (Appendix I and II). All fish captured at each of the sites were identified as to species; length and weight were measured; and a scale was taken for age determination. Catch by species is summarized in Appendix II. For each of the watersheds surveyed; coho length-weight data was summarized (Appendix III), catch/effort for each species was calculated (Table 1) and mean length by age was estimated (Table 2).

STANDARDS USED

At each of the sites sampled, the following information was recorded.

1. **Date:** Date of trap removal.

2. **Site:** Numbered from 1 to 5, where 1 is the lower site and 5 is the upper site.

3. **Area:** Wetted surface trapped, calculated in m^2.

4. **Volume:** Water volume trapped, calculated in m^3 (area x average depth).

5. **Vegetation:** Type of stream-side vegetation which might influence a site's character.

6. **Veg-Age:** An estimate of the approximate age of surrounding vegetation, since harvest. All old-growth was recorded as "100".

7. **Substrate:** The dominant substrate types, where "sand-gravel" represents a site which is composed mostly of sand with some gravel, while "gravel-sand" represents a site composed primarily of gravel with some sand.

8. **Habitat Type:** A descriptive term which characterizes the dominant in-stream cover.

9. **Percent Cover:** A visual estimation of the percentage of a site which is provided with in-stream cover.

10. **Coho:** Coho salmon.

11. **Cut:** Cutthroat trout.

12. **RBT:** Rainbow trout or steelhead juvenile.

13. **Alut:** Aleutian sculpin (Cottus aleuticus).

14. **ASPR:** Prickly sculpin (Cottus asper).

15. **Misc.:** Incidental catches.

16. **Comment:** Common name of species enumerated under "Misc."

RESULTS

The greatest catch/m^2 trapped was obtained in Little Maggie River, Poett Nook Creek and Dutch Harbour Creek East (Table 1; Figure 2). The least fish/m^2 trapped were obtained in Holford Creek, Uchuck Creek and Snug Basin Creek. Catch in Sarita River (lower) was also sparse, but suitable sampling sites were hard to find.

Only 33 of 409 coho captured were 2 year olds (Table 2; Figure 3). The greatest number of 2 year old coho, 9 of 32, were obtained in the Effingham River. Three unlogged watersheds (Effingham River, Clemens Creek and Pipestem River) accounted for 53% of the two year old coho captured.

The largest 1 year olds were obtained in Dutch Harbour Creek West (Table 2; Figure 4) but, sample size was small (n=5). The mean length of 1 year olds for all the creeks surveyed was 82.6 mm. Four creeks (Clemens, Dutch Harbour East, Canoe Pass and Poett Nook) had smaller coho than the mean, while four creeks had larger coho than the mean (Unnamed, Frederick, Little Maggie and Carnation).

Comparison of catch with various habitat variables did not yield any statistically significant results, however some trends were

indicated. Catch was not correlated with biogeoclimatic variant, stream order, watershed orientation or on which side of Barkley Sound the watershed was located on (Figure 5). The catch did appear to decline as stream gradient increased. There was no apparent relationship between percentage in-stream cover and catch (Figure 6). The catch was slightly greater in recently logged watersheds; clear-cut and alder banked streams yielded more fish/site than sites with old-growth riparian cover. There was no clear relationship between catch and either in-stream cover type or substrate type (Figure 7). However, those sites that afforded the best protection from high flows (bridge supports, beaver ponds and complex in-stream debris) supported more coho than exposed sites (boulder, solid rock, single logs and riparian brush).

DISCUSSION

Carnation Creek had a catch of 0.06 coho/m^2 trapped (Figure 2) which falls within the range of other Barkley Sound streams. Actual smolt production from Carnation Creek was 0.16 coho/m^2 (estimate based on 2647 coho smolts from 16,000 m^2 of wetted area; Andersen in preparation). Trapping of coho even within selected locations cannot be considered to represent an actual measure of fish density. The values given in Table 1 are underestimates of actual densities.

The percentage of Carnation Creek's juvenile coho represented by 2 year olds was estimated at 3% (trapping: Figure 3) and at 9% (down-stream fence; Andersen in preparation). These values are within the range of other recently logged Barkley Sound streams. Three of the five streams with the largest percentage 2 year olds (Pipestem, Effingham and Clemens) were unlogged and had 20% of their coho catch composed of 2 year olds. Prior to logging, 45% of Carnation Creek's coho smolts were 2 years olds (Andersen, 1983).

The results obtained from both logged and unlogged Barkley Sound Streams were consistent with the observed decease in percentage 2 year olds produced from Carnation Creek following logging (Holtby and Hartman 1982).

The mean length of 1 year old coho in Carnation Creek was 89 mm while the mean length of coho in Clemens Creek was 70 mm (Figure 4). A difference of 19 mm exists between a recently logged watershed and an unlogged watershed. Prior to logging in Carnation Creek the mean length of 1 year old coho smolts was 76 mm (calculated from Holtby and Hartman 1982) while 1 year old smolts in 1987 averaged 94 mm in length (Andersen in preparation), an increase of 18 mm. The small size of Clemens Creek 1 year old coho noted in this report (Figure 4) is consistent with the mean length observed in Carnation Creek prior to logging.

Fish and habitat information contained within the Barkley Sound data base (Brown et al. in preparation) were compared with information obtained during this survey. The forest cover information and environmental data contained within the data base were accurate when compared to that observed during this survey. Fisheries escapement values however, contained apparent discrepancies when compared to survey information. The actual presences of coho within Sechart Creek and Useless Creek must be questioned as both of these streams have impassable barriers within tidal influence. A third stream examined (Unnamed) was not listed in the fisheries records but did support juvenile coho. Two streams (Dutch Harbour Creek East and Pachena River) had substantial juvenile coho populations, but were rated relatively lower in escapement by fisheries records. However, it must be recognized that this survey sampled coho juveniles and not coho escapement. The escapement

values should be correlated to juvenile catch/effort data with the possible exception of streams such as Little Maggie River which contains excellent coho habitat, but escapement may be limited due to a short accessible length.

Analysis of data obtained during the Barkley Sound stream survey yielded few statistically significant results. Although results were limited due to the nature of the survey, a number of the observations made during the course of this survey will aid future studies of this type. Fish catch and age were noted to be highly variable, however, the sample sizes required to yield statistically significant results during future surveys could be estimated (Sokal and Rohlf, 1969). If the same methods were used again, the number of fish/stream which would have to be sampled in order to detect a 10% difference in mean fish length between two streams at 95% C.L. would be 35. To detect a 5% difference in mean fish length between two streams, 140 fish lengths/stream would be required. Using minnow traps as a method of capture, 25 sites would be required to be 95% certain of detecting a 100% difference in fish abundance.

ACKNOWLEDGMENTS

The assistance of C. Scrivener, A. Langston and E. Choromanski in collecting data was essential for project completion. The help provided by V. Ogilvie in preparation of this manuscript was greatfully appreciated.

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TABLE 1. CATCH SUMMARY RELATIVE TO AREA TRAPPED

NO.	NAME	COHO		CUTTHROAT		RAINBOW		ASPER	
		NO/SQ.M	SD	NO/SQ.M	SD	NO/SQ.M	SD	NO/SQ.M	SD
27	LITTLE MAGGIE RIVER	0.116	0.053	0.000	0.000	0.000	0.000	0.056	0.053
45	POETT NOOK CREEK	0.088	0.044	0.001	0.001	0.000	0.000	0.000	0.000
16	DUTCH HARBOUR CREEK EAST	0.087	0.038	0.000	0.000	0.000	0.000	0.098	0.103
18	EFFINGHAM RIVER	0.064	0.066	0.000	0.000	0.007	0.014	0.090	0.092
4	CARNATION CREEK	0.061	0.074	0.005	0.010	0.005	0.010	0.040	0.064
65	UNK (ED EAST)	0.054	0.048	0.000	0.000	0.000	0.000	0.037	0.039
42	PARADISE CREEK	0.048	0.063	0.000	0.000	0.022	0.027	0.010	0.010
41	PACHENA RIVER	0.047	0.031	0.004	0.005	0.000	0.000	0.143	0.083
15	DRAW CREEK	0.042	0.040	0.000	0.000	0.012	0.011	0.000	0.000
17	DUTCH HARBOUR CREEK WEST	0.038	0.077	0.016	0.019	0.000	0.000	0.107	0.106
20	FREDERICK CREEK	0.036	0.025	0.005	0.006	0.006	0.007	0.022	0.004
9	CLEMENS CREEK	0.032	0.027	0.000	0.000	0.000	0.001	0.020	0.015
3	CANOE PASS CREEK	0.021	0.021	0.000	0.000	0.000	0.000	0.056	0.032
44	PIPESTEM RIVER	0.017	0.021	0.000	0.000	0.191	0.294	0.074	0.063
59	TWO RIVERS EAST	0.010	0.006	0.001	0.002	0.000	0.000	0.003	0.004
28	LITTLE TOQUART CREEK	0.009	0.011	0.000	0.000	0.002	0.002	0.076	0.114
60	TWO RIVERS WEST	0.007	0.004	0.000	0.000	0.000	0.000	0.010	0.020
52	SNUG BASIN CREEK	0.005	0.007	0.000	0.000	0.000	0.000	0.146	0.092
48	SARITA (LOWER)	0.005	0.010	0.004	0.007	0.008	0.010	0.035	0.019
61	UCHUCK CREEK	0.004	0.005	0.000	0.000	0.003	0.006	0.001	0.002
22	HOLFORD CREEK	0.002	0.004	0.000	0.000	0.000	0.000	0.061	0.049

TABLE 2. AGE AND MEAN LENGTH OF JUVENILE COHO

NO.	NAME	CATCH	CUT-OFF YR1	CUT-OFF YR2	CUT-OFF VALUE	% YR2	MEAN LENGTH N1	MEAN LENGTH YR1	MEAN LENGTH SD1	MEAN LENGTH N2	MEAN LENGTH YR2	MEAN LENGTH SD2
3	CANOE PASS CREEK	15	89	93	91	6.6	13	76.5	5.3	2	96.5	
4	CARNATION CREEK	31	104	112	108	3.2	30	89.3	5.7	1	112.0	
9	CLEMENS CREEK	51	87	91	89	11.8	46	70.4	8.6	5	97.8	8.8
15	DRAW CREEK	10	106			0.0	10	87.5	10.9	0		
16	DUTCH HARBOUR CREEK EAST	34	124			0.0	34	75.8	8.8	0		
17	DUTCH HARBOUR CREEK WEST	5	124			0.0	5	110.6	9.3	0		
18	EFFINGHAM RIVER	32	104	94	97	28.1	23	85.8	9.1	9	103.7	4.8
20	FREDERICK CREEK	29	104			0.0	29	87.4	11.2	0		
22	HOLFORD CREEK	1		119		100.0	0			1	119.0	
27	LITTLE MAGGIE RIVER	52	110	104	107	1.9	51	87.2	10.0	1	104.0	
28	LITTLE TOQUART CREEK	5	100			0.0	5	89.8	8.4	0		
41	PACHENA RIVER	27	109	95	112	7.4	25	87.2	11.2	2	105.0	
42	PARADISE CREEK	18	100	107	104	5.6	17	84.1	11.1	1	107.0	
44	PIPESTEM RIVER	4	95	100	98	75.0	1	95.0		3	102.7	3.1
45	POETT NOOK CREEK	49	107	110	109	9.5	45	78.1	14.2	4	115.0	3.7
48	SARITA (LOWER)	1	96			0.0	1	96.0		0		
52	SNUG BASIN CREEK	4	82	85	84	50.0	2	75.0		2	85.5	
59	TWO RIVERS EAST	9	98			0.0	9	85.4	8.8	0		
60	TWO RIVERS WEST	6	93	98	96	33.3	4	86.8	7.0	2	98.5	
61	UCHUCK CREEK	3	97			0.0	3	90.3	6.2	0		
65	UNK (ED EAST)	23	103			0.0	23	86.1	7.3	0		

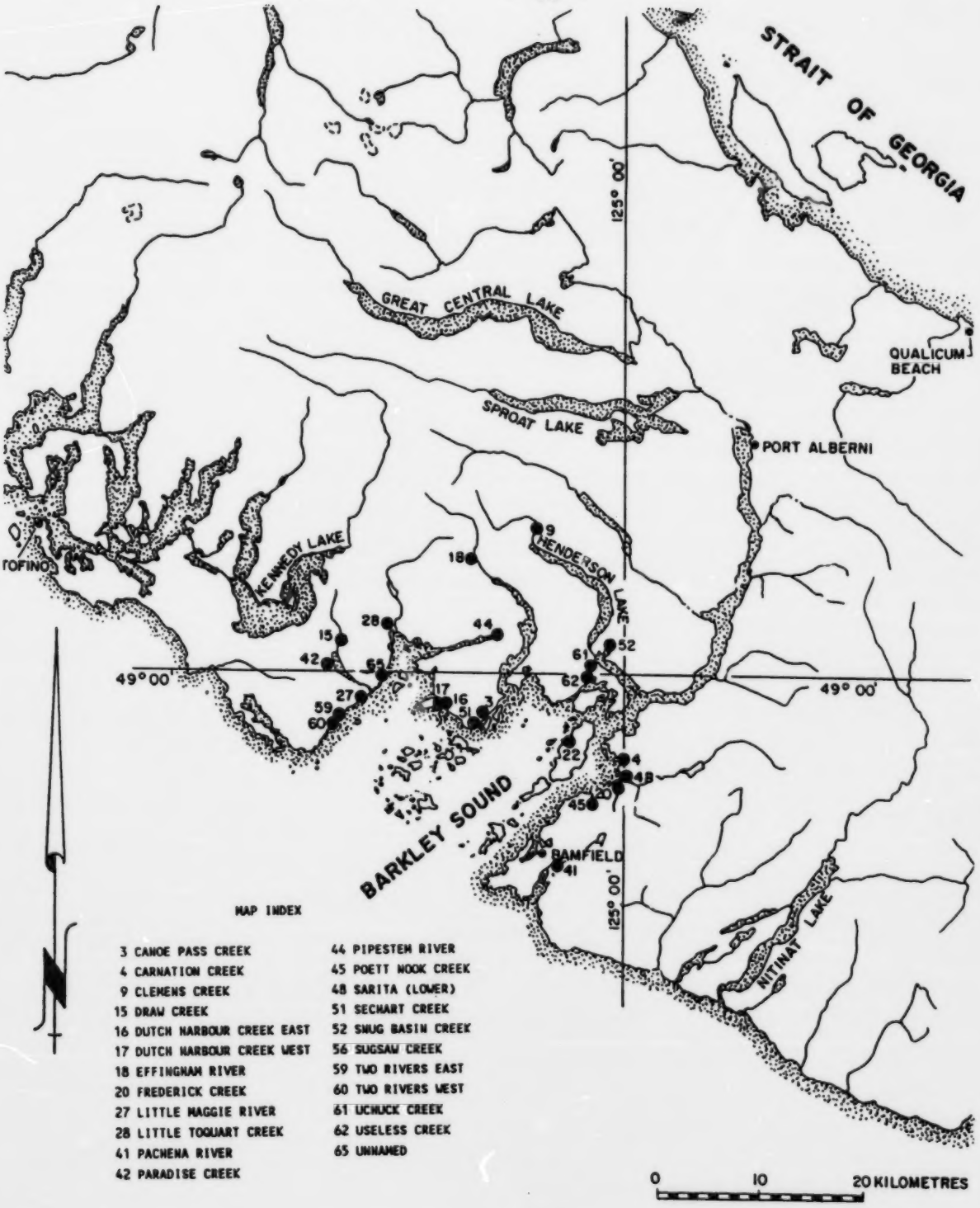


Figure 1. Map of Barkley Sound indicating location of 23 streams surveyed. Stream numbers correspond to those given by Brown et al. (1987).

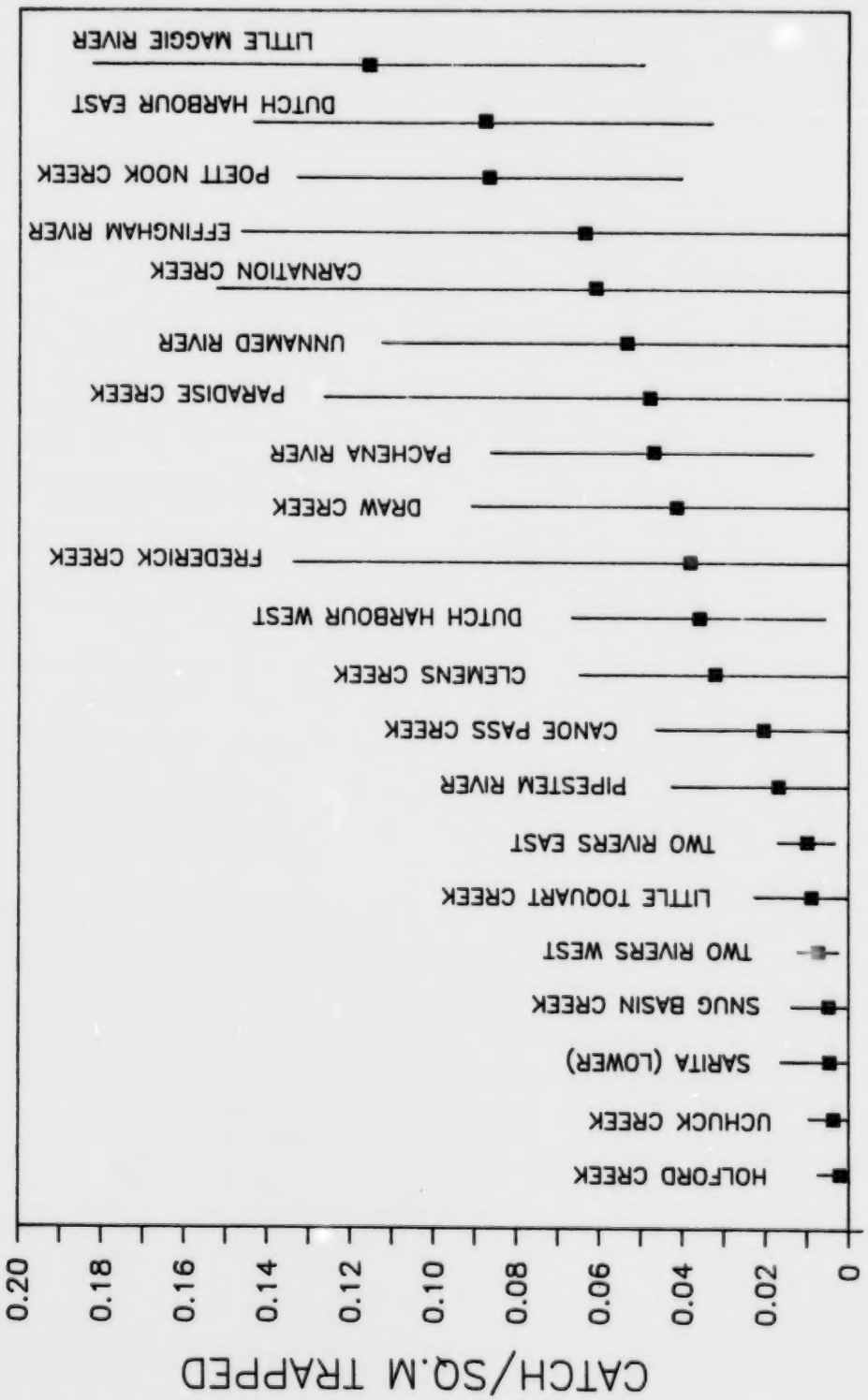


Figure 2. Juvenile coho catch/effort by watershed. Vertical bars represent 95% C.L.

Figure 3. Percentage 2 year old coho by watershed.

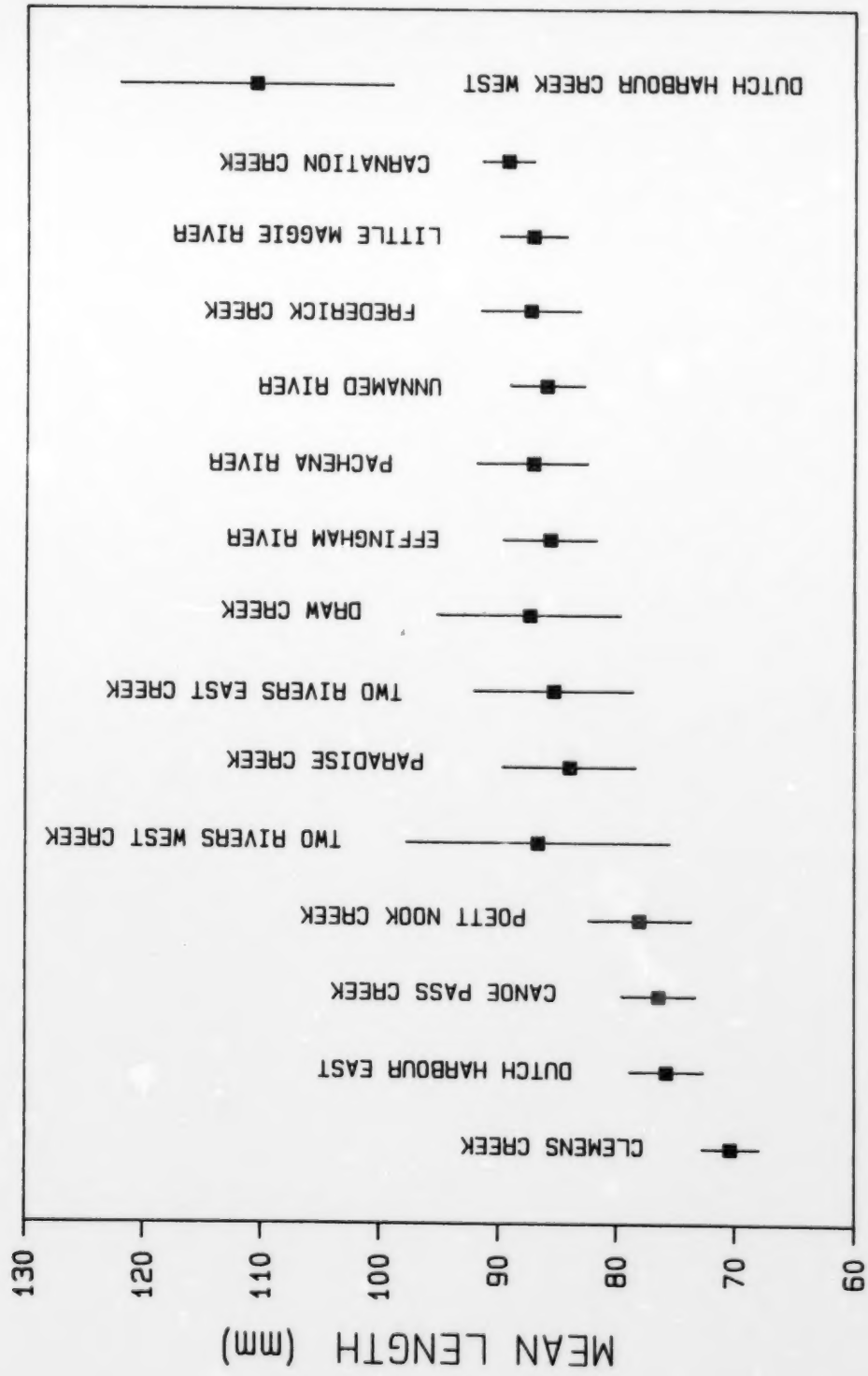


Figure 4. Mean length of 1 year old coho (March 19 to April 12).

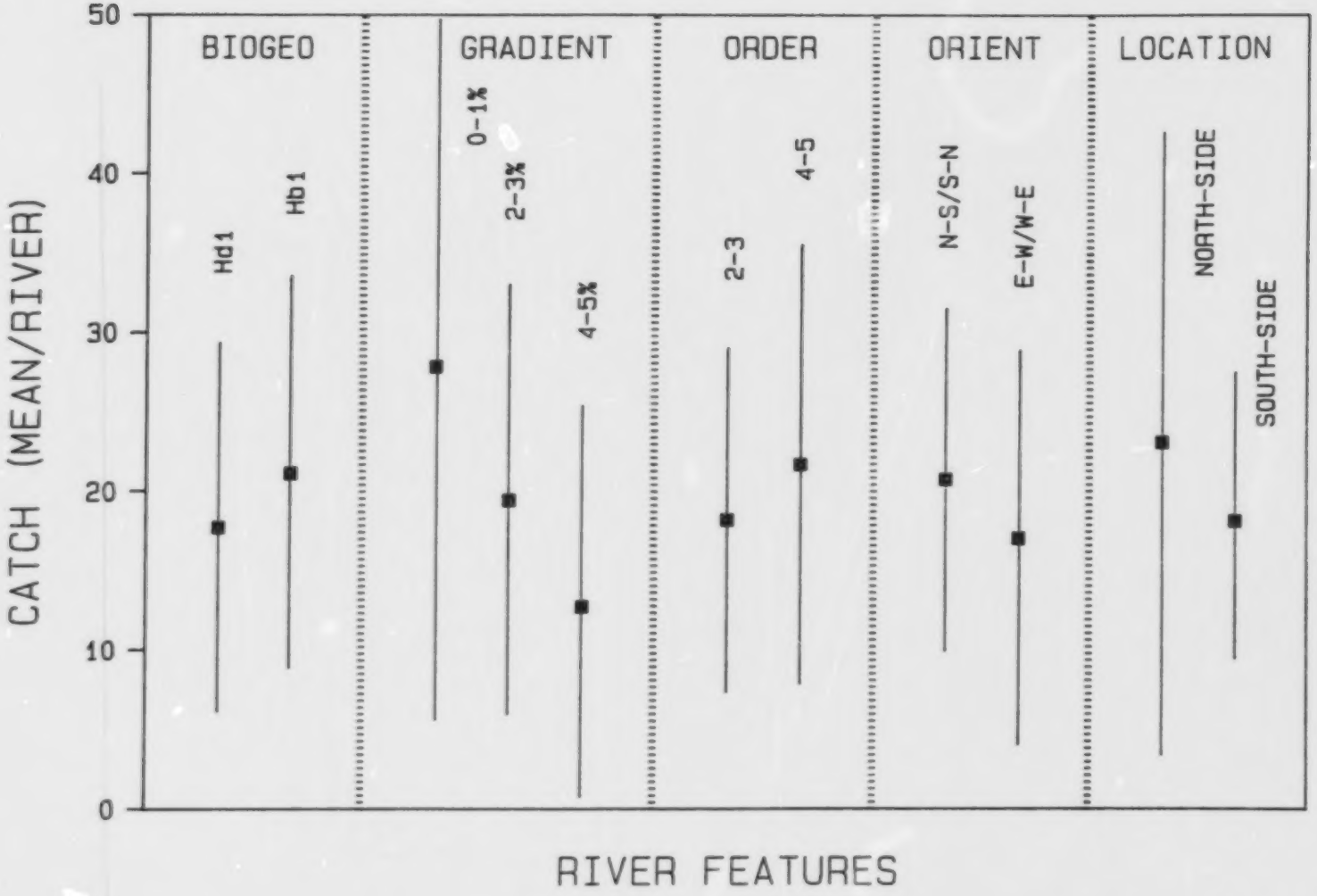


Figure 5. Juvenile coho catch relative to watershed features.

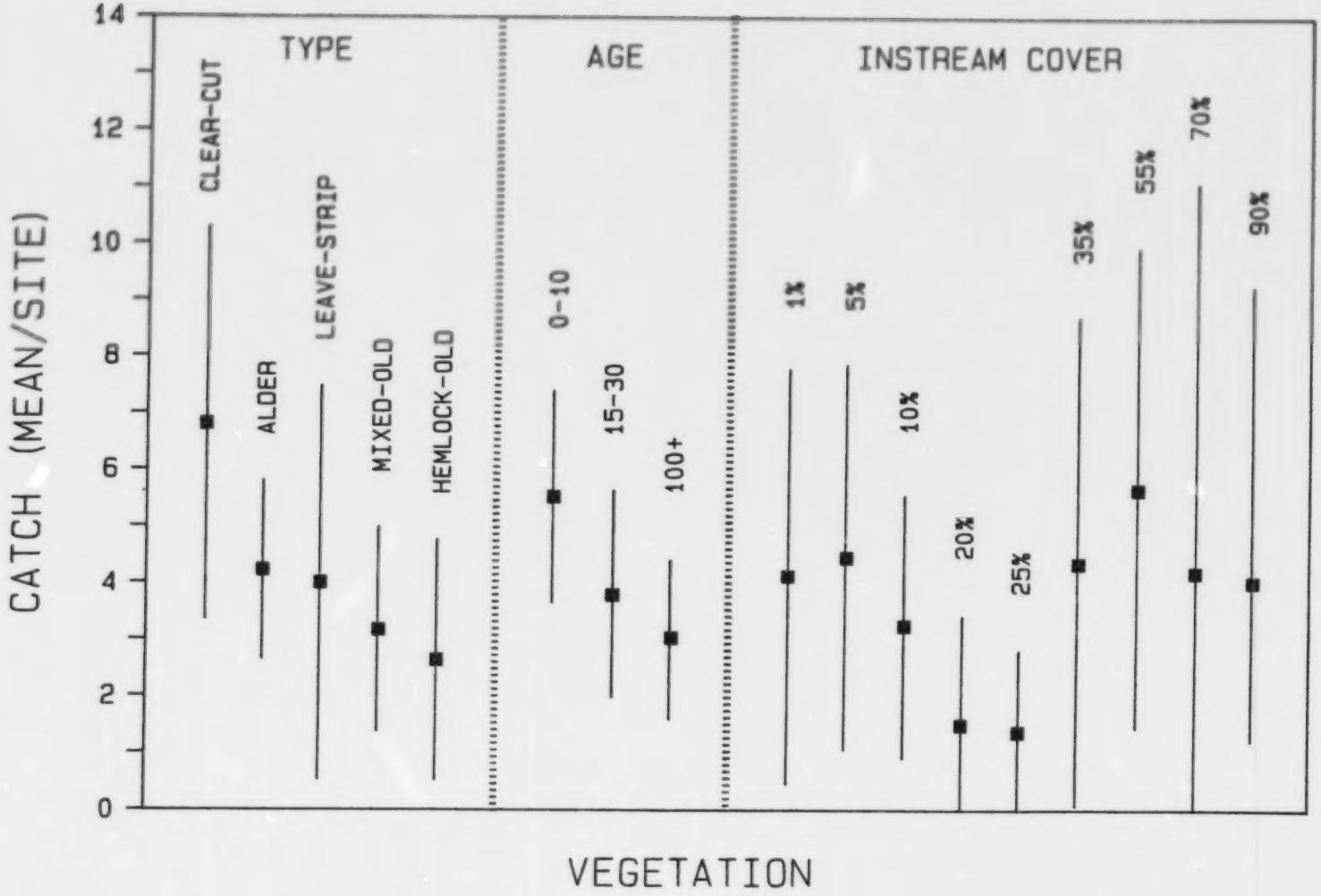


Figure 6. Coho catch relative to riparian features and cover.

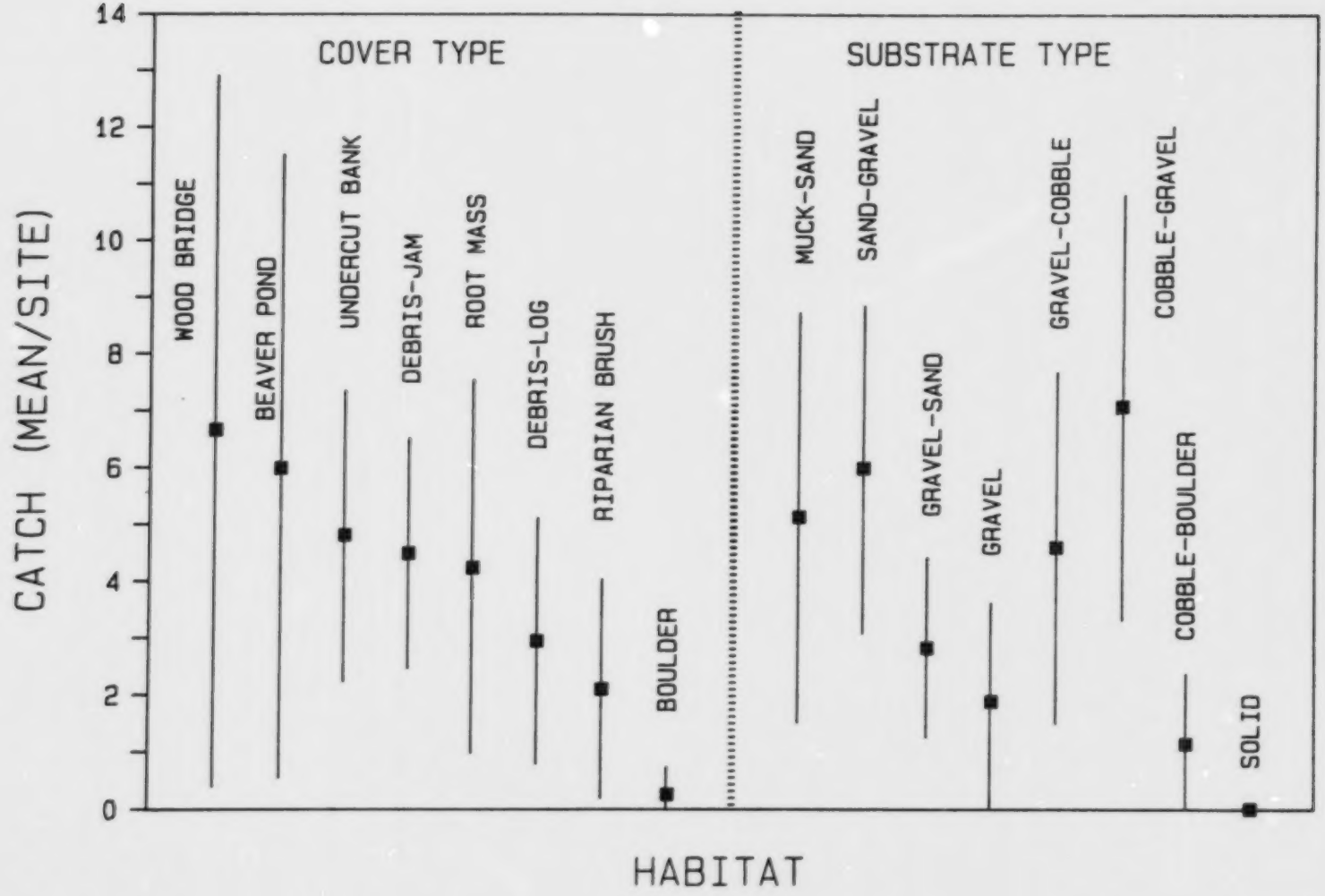


Figure 7. Coho catch relative to in-stream habitat features.

Appendix I Habitat characteristics for all sites

NO	NAME	SITE	VEGETATION	VEG-AGE	SUBSTRATE	% COVER	HABITAT-TYPE
41	PACHENA RIVER	1	ALDER	25	COBBLE-SAND	2	UNDERCUT BANK
		2	ALDER	25	SAND-GRAVEL	15	UNDERCUT BANK
		3	ALDER	25	COBBLE-GRAVEL	5	UNDERCUT BANK
		4	ALDER	25	COBBLE-GRAVEL	5	UNDERCUT BANK
		5	ALDER	25	COBBLE-GRAVEL	20	ROOT MASS
45	POETT NOOK CREEK	1	ALDER	25	MUCK-SAND	10	BEAVER CHANNEL
		2	ALDER	25	MUCK-SAND	10	BEAVER POND
		3	ALDER	25	SAND-GRAVEL	2	RIPARIAN BRUSH
		4	ALDER	25	GRAVEL-SAND	2	WOOD BRIDGE
		5	ALDER	25	SAND-GRAVEL	10	ROOT MASS
20	FREDERICK CREEK	1	SALMONBERRY	10	SAND-GRAVEL	50	DEBRIS-JAM
		2	SALMONBERRY	10	SAND-GRAVEL	25	DEBRIS-JAM
		3	SALMONBERRY	10	SAND-GRAVEL	25	DEBRIS-JAM
		4	SALMONBERRY	10	SAND-GRAVEL	15	UNDERCUT BANK
		5	SALMONBERRY	10	SAND-GRAVEL	80	DEBRIS-JAM
48	SARITA (LOWER)	1	MIXED-OLD	100	GRAVEL-SAND	2	UNDERCUT BANK
		2	MIXED-OLD	100	GRAVEL-SAND	20	RIPARIAN BRUSH
		3	MIXED-OLD	100	SAND-GRAVEL	60	ROOT MASS
		4	MIXED-OLD	100	SAND-GRAVEL	40	ROOT MASS
		5	MIXED-OLD	100	COBBLE-GRAVEL	50	ROOT MASS
22	HOLFORD CREEK	1	HEMLOCK-OLD	100	SOLID-BOULDER	25	DEBRIS-LOG
		2	HEMLOCK-OLD	100	SOLID-COBBLE	25	ROOT MASS
		3	HEMLOCK-OLD	100	COBBLE-GRAVEL	5	DEBRIS-LOG
		4	HEMLOCK-OLD	100	SOLID	0	BOULDER
		5	HEMLOCK-OLD	100	SOLID-BOULDER	0	DEEP POOL
4	CARNATION CREEK	1	LEAVE-STRIP	10	SAND-GRAVEL	30	DEBRIS-JAM
		2	LEAVE-STRIP	10	GRAVEL-SAND	55	DEBRIS-JAM
		3	LEAVE-STRIP	10	GRAVEL	35	DEBRIS-JAM
		4	LEAVE-STRIP	10	GRAVEL	25	DEBRIS-JAM
		5	LEAVE-STRIP	10	SAND-GRAVEL	15	DEBRIS-JAM
28	LITTLE TOQUART CREEK	1	MIXED-OLD	100	SAND-GRAVEL	20	DEBRIS-JAM
		2	MIXED-OLD	100	GRAVEL	20	DEBRIS-JAM
		3	MIXED-OLD	100	SAND-GRAVEL	10	DEBRIS-JAM
		4	MIXED-OLD	100	GRAVEL	5	UNDERCUT BANK
		5	MIXED-OLD	100	GRAVEL	30	DEBRIS-JAM
59	TWO RIVERS EAST	1	MIXED-OLD	100	GRAVEL	15	ROOT MASS
		2	MIXED-OLD	100	GRAVEL	10	DEBRIS-LOG
		3	MIXED-OLD	100	GRAVEL	15	DEBRIS-LOG
		4	MIXED-OLD	100	GRAVEL	15	DEBRIS-LOG
		5	MIXED-OLD	100	GRAVEL	5	RIPARIAN BRUSH
60	TWO RIVERS WEST	1	MIXED-OLD	100	COBBLE	5	DEBRIS-LOG
		2	MIXED-OLD	100	COBBLE-SAND	5	ROOT MASS
		3	MIXED-OLD	100	BOULDER-GRAVEL	5	DEBRIS-LOG
		4	MIXED-OLD	100	SAND-MUCK	20	DEBRIS-LOG
		5	MIXED-OLD	100	SAND-MUCK	20	DEBRIS-LOG
3	CANOE PASS CREEK	1	HEMLOCK-OLD	100	COBBLE-BOULDER	10	DEBRIS-LOG
		2	HEMLOCK-OLD	100	BOULDERS	0	BOULDER
		3	MIXED-OLD	100	SAND-MUCK	5	BEAVER POND
		4	MIXED-OLD	100	GRAVEL-MUCK	10	BEAVER POND
		5	MIXED-OLD	100	SAND-MUCK	15	BEAVER POND
61	UCHUCK CREEK	1	LEAVE-STRIP	10	SAND	70	DEBRIS-JAM
		2	LEAVE-STRIP	10	GRAVEL	65	DEBRIS-JAM
		3	LEAVE-STRIP	10	GRAVEL-SAND	90	DEBRIS-JAM
		4	LEAVE-STRIP	10	GRAVEL-SAND	85	DEBRIS-JAM
		5	LEAVE-STRIP	10	GRAVEL	25	DEBRIS-JAM

NO	NAME	SITE	VEGETATION	VEG-AGE	SUBSTRATE	% COVER	HABITAT-TYPE
52	SNUG BASIN CREEK	1	ALDER	30	GRAVEL-SAND	15	ROOT MASS
		2	ALDER	30	GRAVEL-SAND	10	DEBRIS-LOG
		3	ALDER	30	GRAVEL-SAND	25	DEBRIS-JAM
		4	ALDER	30	GRAVEL-SAND	5	ROOT MASS
		5	ALDER	30	GRAVEL-SAND	10	UNDERCUT BANK
27	LITTLE MAGGIE RIVER	1	CLEARCUT	5	GRAVEL-COBBLE	55	DEBRIS-LOG
		2	CLEARCUT	5	GRAVEL-COBBLE	85	DEBRIS-JAM
		3	CLEARCUT	5	COBBLE-GRAVEL	30	DEBRIS-JAM
		4	CLEARCUT	2	COBBLE-GRAVEL	50	DEBRIS-JAM
		5	LEAVE-STRIP	5	COBBLE-GRAVEL	10	DEBRIS-LOG
44	PIPESTEM RIVER	1	MIXED-OLD	100	GRAVEL-COBBLE	40	DEBRIS-LOG
		2	MIXED-OLD	100	GRAVEL-COBBLE	10	DEBRIS-LOG
		3	MIXED-OLD	100	GRAVEL-COBBLE	5	BOULDER
		4	MIXED-OLD	100	COBBLE-BOULDER	30	DEBRIS-LOG
		5	MIXED-OLD	100	COBBLE-BOULDER	95	DEBRIS-JAM
17	DUTCH HARBOUR CREEK WEST	1	ALDER	15	GRAVEL	30	RIPARIAN BRUSH
		2	ALDER	15	GRAVEL-COBBLE	5	RIPARIAN BRUSH
		3	ALDER	15	COBBLE-GRAVEL	40	UNDERCUT BANK
		4	ALDER	15	SOLID-COBBLE	15	DEBRIS-LOG
		5	ALDER	15	SOLID-COBBLE	35	DEBRIS-JAM
42	PARADISE CREEK	1	HEMLOCK-OLD	100	SAND-GRAVEL	75	DEBRIS-JAM
		2	HEMLOCK-OLD	100	GRAVEL-SAND	5	DEBRIS-LOG
		3	ALDER	10	GRAVEL-COBBLE	65	ROOT MASS
		4	ALDER	10	GRAVEL-SAND	85	DEBRIS-LOG
		5	ALDER	10	GRAVEL-COBBLE	20	WOOD BRIDGE
18	EFFINGHAM RIVER	1	MIXED-OLD	100	GRAVEL	10	DEBRIS-JAM
		2	MIXED-OLD	100	GRAVEL	65	ROOT MASS
		3	MIXED-OLD	100	GRAVEL	90	DEBRIS-JAM
		4	MIXED-OLD	100	SAND-GRAVEL	90	ROOT MASS
		5	MIXED-OLD	100	GRAVEL-SAND	35	DEBRIS-JAM
65	UNNAMED	1	SALMONBERRY	10	GRAVEL-COBBLE	15	RIPARIAN BRUSH
		2	ALDER	10	GRAVEL-COBBLE	5	UNDERCUT BANK
		3	SALMONBERRY	10	GRAVEL-COBBLE	20	RIPARIAN BRUSH
		4	ALDER	10	COBBLE-GRAVEL	2	DEEP POOL
		5	ALDER	10	GRAVEL-COBBLE	95	DEBRIS-JAM
16	DUTCH HARBOUR CREEK EAST	1	HEMLOCK-OLD	100	GRAVEL-SAND	10	RIPARIAN BRUSH
		2	HEMLOCK-OLD	100	GRAVEL-SAND	15	UNDERCUT BANK
		3	HEMLOCK-OLD	100	GRAVEL-SAND	15	DEBRIS-LOG
		4	HEMLOCK-OLD	100	GRAVEL-SAND	15	DEBRIS-JAM
		5	HEMLOCK-OLD	100	GRAVEL-SAND	25	DEBRIS-JAM
15	DRAW CREEK	1	ALDER	25	MUCK	10	SIDE-POOL
		2	ALDER	25	BOULDER-GRAVEL	10	WOOD BRIDGE
		3	ALDER	25	GRAVEL-COBBLE	10	ROOT MASS
		4	ALDER	25	GRAVEL-SAND	10	ROOT MASS
		5	ALDER	25	GRAVEL-COBBLE	10	RIPARIAN BRUSH
9	CLEMENS CREEK	1	MIXED-OLD	100	GRAVEL-SAND	5	BOULDER
		2	MIXED-OLD	100	COBBLE-GRAVEL	5	DEBRIS-LOG
		3	MIXED-OLD	100	GRAVEL-COBBLE	5	DEBRIS-JAM
		4	MIXED-OLD	100	GRAVEL-SAND	10	DEBRIS-LOG
		5	MIXED-OLD	100	SAND-GRAVEL	15	ROOT MASS

NO	NAME	DATE	SITE	AREA SQ.M	VOLUME CU.M	CATCH COHO	CUT	RBT	ALUT	ASPR	MISC	COMMENT
41	PACHENA RIVER	31-Mar	1	148	44	9	0	0	0	4	1	CRAWFISH
			2	84	50	4	1	0	0	23	0	
			3	187	75	6	0	0	0	30	0	
			4	84	67	8	0	0	0	14	1	CRAWFISH
			5	162	113	0	1	0	0	14	0	
45	POETT NOOK CREEK	01-Apr	1	80	24	8	0	0	0	0	3	STICKLEBACK
			2	291	117	8	1	0	0	0	0	
			3	110	22	5	0	0	0	0	1	
			4	112	28	10	0	0	1	0	0	
			5	116	35	18	0	0	1	0	1	COHO FRY
20	FREDERICK CREEK	01-Apr	1	180	90	8	0	3	0	5	0	
			2	184	74	4	0	0	0	4	0	
			3	80	64	0	1	1	0	2	0	
			4	160	96	12	2	0	0	3	1	COHO FRY
			5	126	63	5	0	0	0	2	1	COHO FRY
48	SARITA (LOWER)	02-Apr	1	84	84	0	0	0	0	3	2	STICKLEBACK, LAMPREY
			2	227	125	0	0	0	0	0	2	STICKLEBACK, LAMPREY
			3	56	39	0	1	1	0	2	6	STICKLEBACK
			4	36	32	0	0	0	0	2	0	
			5	42	42	1	0	1	0	2	0	
22	HOLFORD CREEK	02-Apr	1	24	6	0	0	0	2	3	2	COHO FRY
			2	48	24	0	0	0	0	5	2	COHO FRY
			3	91	18	1	0	0	0	6	0	
			4	84	8	0	0	0	2	1	0	
			5	11	32	0	0	0	10	0	0	
4	CARNATION CREEK	02-Apr	1	78	39	16	2	2	0	1	0	
			2	149	119	8	0	0	0	25	0	
			3	120	120	2	0	0	0	1	0	
			4	130	96	1	0	0	0	1	0	
			5	176	176	4	0	0	0	1	0	
28	LITTLE TOQUART CREEK	20-Mar	1	222	89	2	0	1	0	1	0	
			2	220	66	0	0	0	0	6	0	
			3	281	56	1	0	1	0	3	0	
			4	33	17	1	0	0	0	10	0	
			5	368	110	1	0	1	0	13	0	
59	TWO RIVERS EAST	21-Mar	1	162	81	1	0	0	0	0	0	
			2	213	106	1	0	0	1	2	0	
			3	152	76	3	0	0	3	1	0	
			4	145	22	1	0	0	1	0	0	
			5	228	23	3	1	0	5	0	1	COHO FRY
60	TWO RIVERS WEST	21-Mar	1	108	43	1	0	0	1	0	0	
			2	180	108	2	0	0	1	0	0	
			3	255	77	0	0	0	0	0	0	
			4	98	49	1	0	0	0	5	0	
			5	152	61	1	0	0	0	0	0	
3	CANOE PASS CREEK	22-Mar	1	70	14	0	0	0	0	1	0	
			2	40	16	1	0	0	0	4	0	
			3	192	115	11	0	0	0	7	5	STICKLEBACK
			4	105	63	0	0	0	0	9	8	STICKLEBACK
			5	143	72	3	0	0	0	6	4	STICKLEBACK

NO	NAME	DATE	SITE	AREA SQ.M	VOLUME CU.M	CATCH COHO	CUT	RBT	ALUT	ASPR	MISC	COMMENT
61	UCHUCK CREEK	19-Mar	1	253	89	2	0	0	0	1	1	STICKLEBACK
			2	140	70	1	0	2	0	0	0	
			3	190	76	0	0	0	0	0	0	
			4	220	132	0	0	0	0	0	0	
			5	308	157	0	0	0	0	0	0	
52	SNUG BASIN CREEK	19-Mar	1	106	55	2	0	0	0	17	0	
			2	110	59	0	0	0	0	32	0	
			3	351	341	2	0	0	0	24	0	
			4	257	154	0	0	0	0	7	0	
			5	120	71	0	0	0	0	22	0	
27	LITTLE MAGGIE RIVER	23-Mar	1	52	24	9	0	0	0	2	0	
			2	48	19	7	0	0	0	0	0	
			3	115	69	18	0	0	0	18	0	
			4	184	138	8	0	0	0	9	0	
			5	168	92	10	0	0	0	6	0	
44	PIPESTEM RIVER	21-Mar	1	90	41	2	0	4	0	13	0	
			2	112	97	0	0	4	0	16	0	
			3	80	29	0	0	4	0	6	0	
			4	133	126	1	0	6	0	1	0	
			5	18	7	1	0	14	0	0	0	
17	DUTCH HARBOUR CREEK WEST	21-Mar	1	42	10	0	0	0	0	2	0	
			2	101	30	0	0	0	0	5	0	
			3	26	9	5	1	0	0	8	0	
			4	17	4	0	0	0	0	2	0	
			5	75	30	0	3	0	0	1	0	
42	PARADISE CREEK	23-Mar	1	189	127	1	0	0	0	1	0	
			2	137	86	0	0	1	0	0	0	
			3	68	19	3	0	5	0	0	0	
			4	41	21	7	0	1	0	1	0	
			5	333	632	7	0	2	0	6	0	
18	EFFINGHAM RIVER	19-Mar	1	572	252	0	0	0	1	0	0	
			2	85	26	14	0	3	0	3	0	
			3	40	23	1	0	0	0	7	0	
			4	116	116	14	0	0	0	26	0	
			5	352	581	3	0	0	0	5	0	
65	UNNAMED	23-Mar	1	92	47	3	0	0	0	2	0	
			2	91	55	3	0	0	0	4	0	
			3	91	30	1	0	0	0	1	0	
			4	88	47	4	0	0	0	0	0	
			5	82	40	12	0	0	0	9	0	
16	DUTCH HARBOUR CREEK EAST	21-Mar	1	46	13	6	0	0	0	13	0	
			2	44	11	5	0	0	0	0	0	
			3	180	36	7	0	0	0	0	1	COHO FRY
			4	112	59	12	0	0	0	12	0	
			5	90	72	4	0	0	0	9	0	
15	DRAW CREEK	23-Mar	1	45	18	4	0	0	0	0	4	SALAMANDERS
			2	45	22	4	0	0	0	0	0	
			3	65	32	2	0	2	0	0	0	
			4	84	113	0	0	1	0	0	0	
			5	67	21	0	0	1	0	0	0	
9	CLEMENS CREEK	19-Mar	1	531	690	0	0	1	0	2	0	
			2	413	495	20	0	0	0	1	0	
			3	339	339	20	0	0	0	8	1	DOLLY VARDEN
			4	252	353	0	0	0	0	8	0	
			5	203	173	11	0	0	0	8	0	

Appendix III Coho salmon and Rainbow trout length frequency distribution and length/weight relationship for all watersheds in which more than 4 fish of a given species were captured.

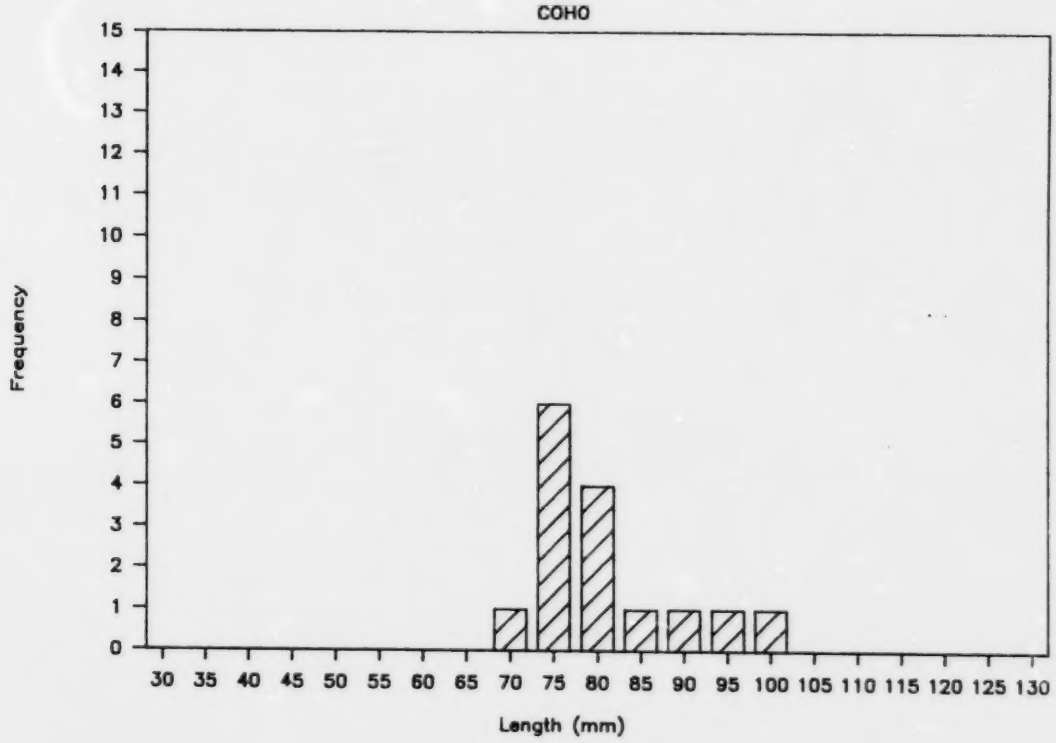
COHO SALMON

CANOE PASS CREEK
CARNATION CREEK
CLEMENS CREEK
DRAW CREEK
DUTCH HARBOUR CREEK EAST
EFFINGHAM RIVER
FREDERICK CREEK
LITTLE MAGGIE RIVER
PACHENA RIVER
PARADISE CREEK
POETT NOOK CREEK
TWO RIVERS EAST CREEK
TWO RIVERS WEST CREEK
UNNAMED CREEK

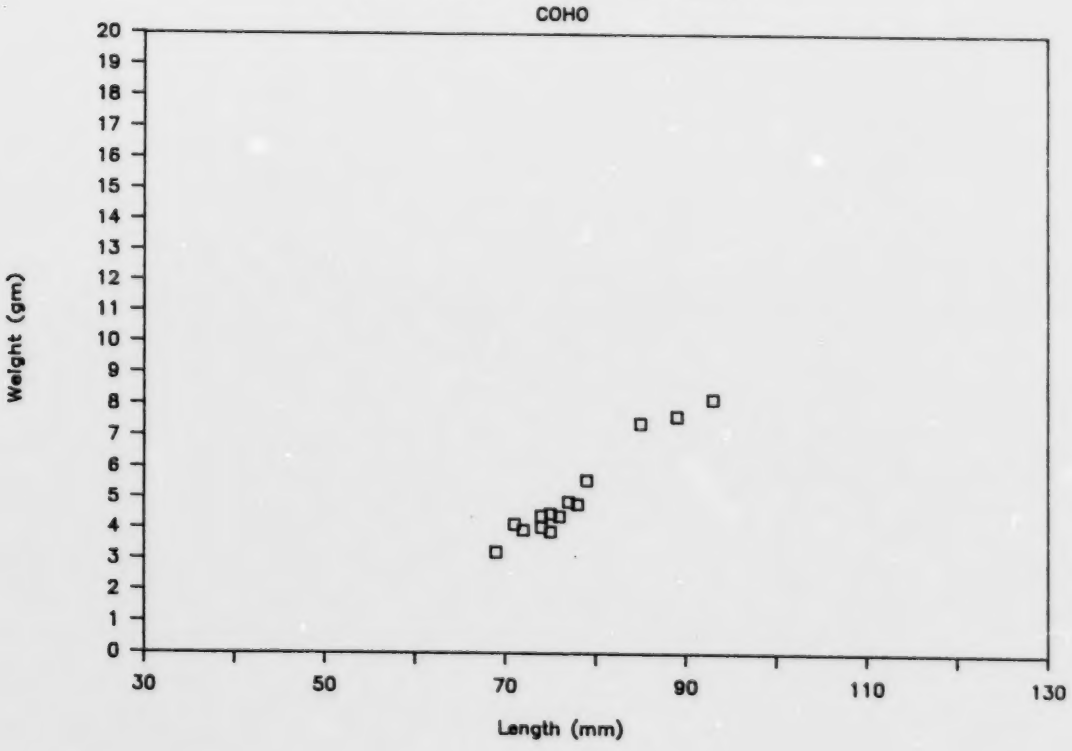
RAINBOW TROUT

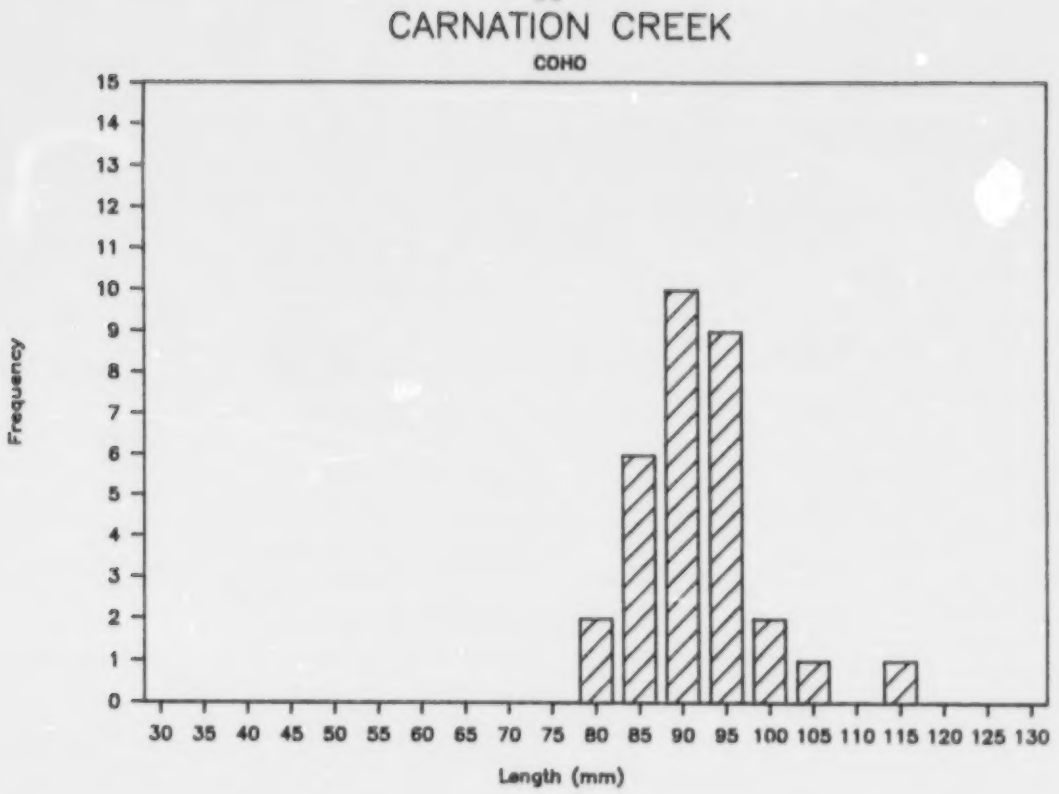
PARADISE CREEK
PIPESTEM RIVER

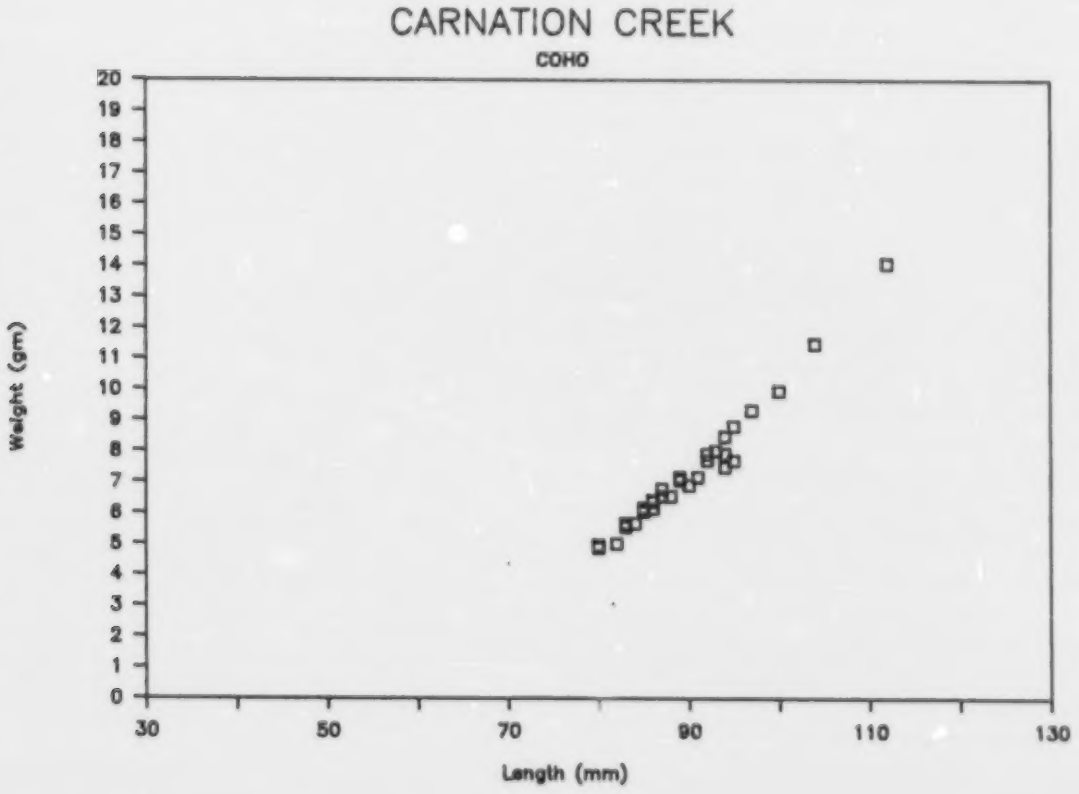
CANOE PASS CREEK



CANOE PASS CREEK

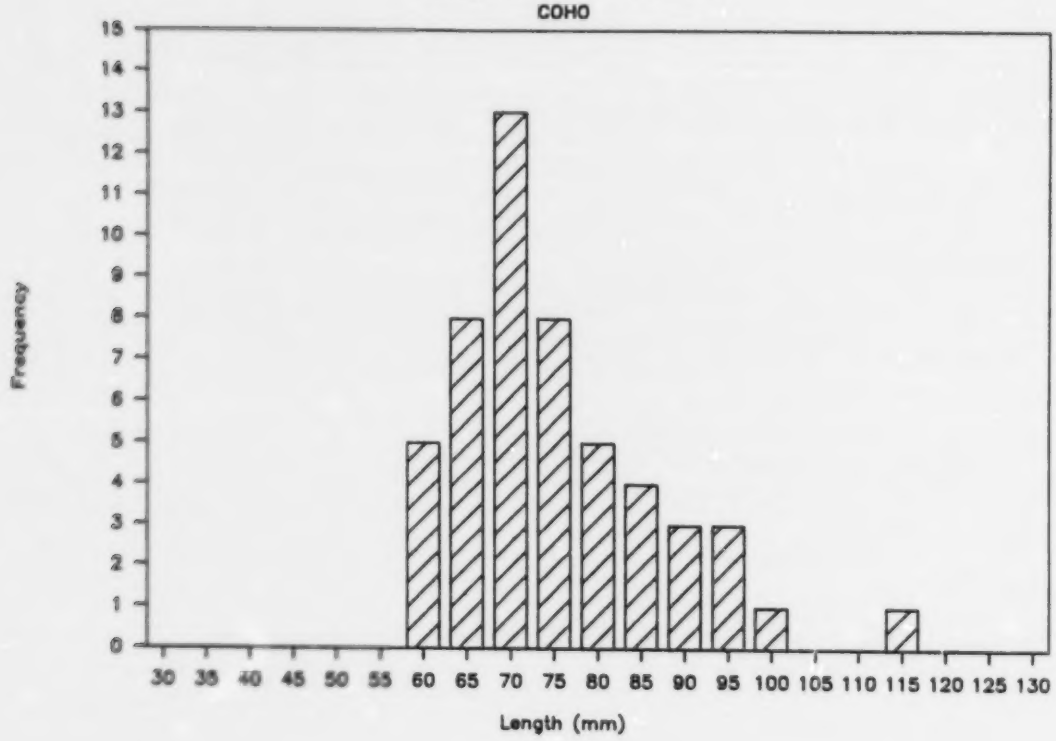



CARNATION CREEK
COHO
Frequency
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130
Length (mm)


CARNATION CREEK
COHO
Weight (gm)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
30 50 70 90 110 130
Length (mm)

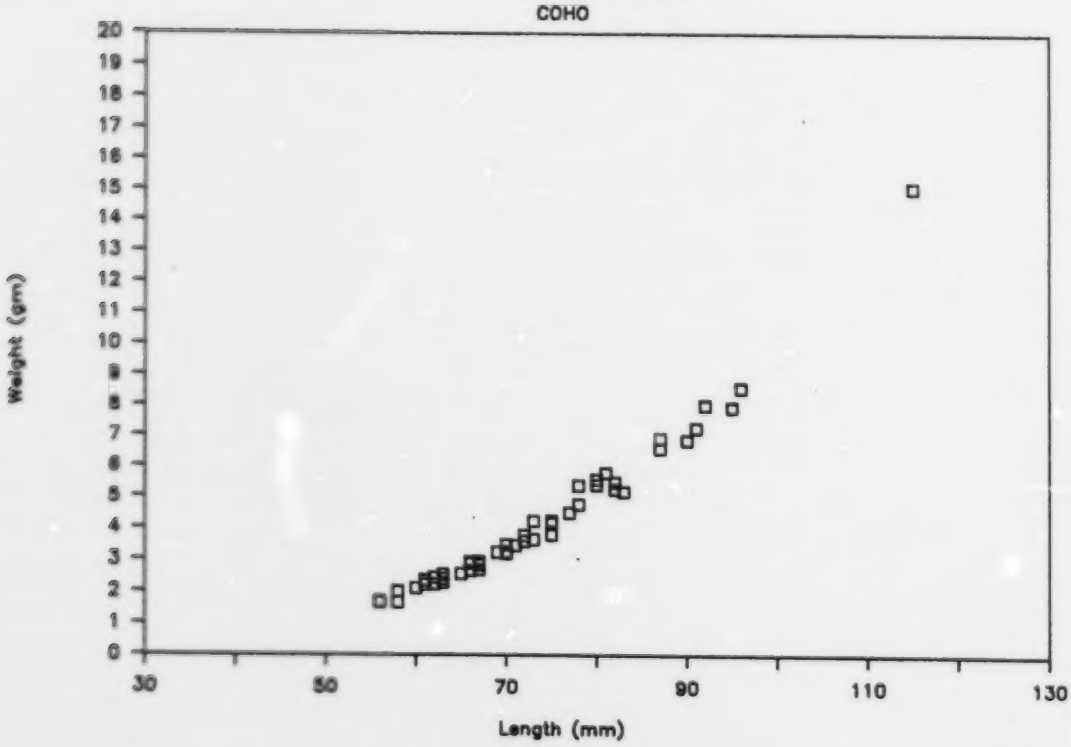
CLEMENS CREEK

COHO



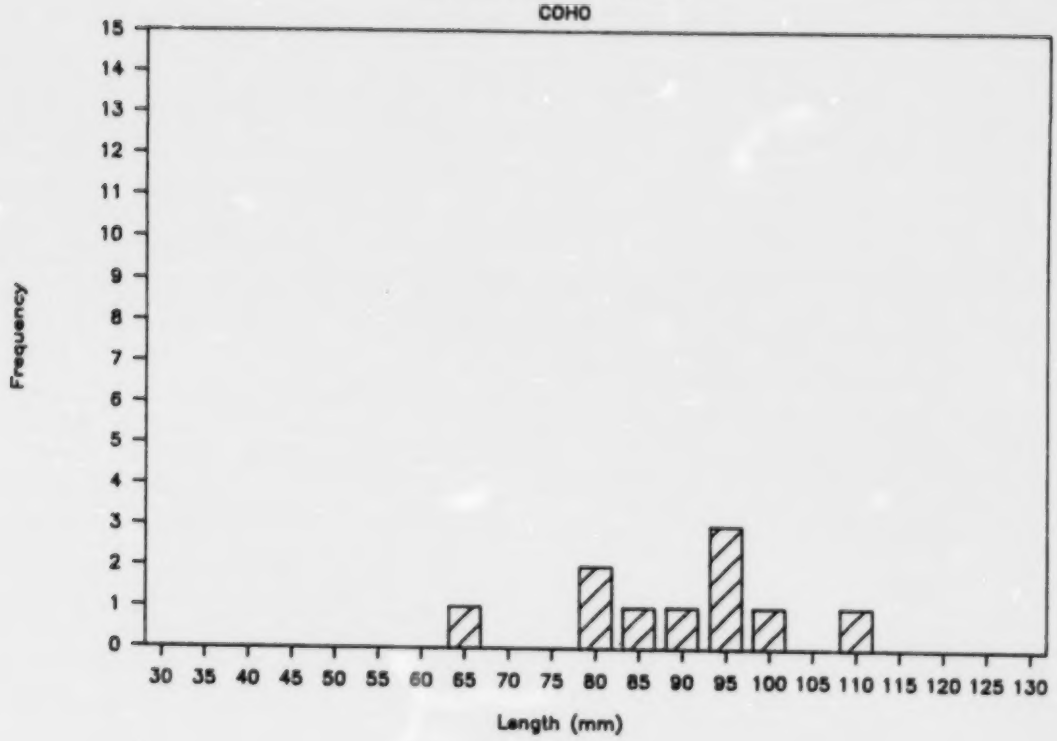
CLEMENS CREEK

COHO



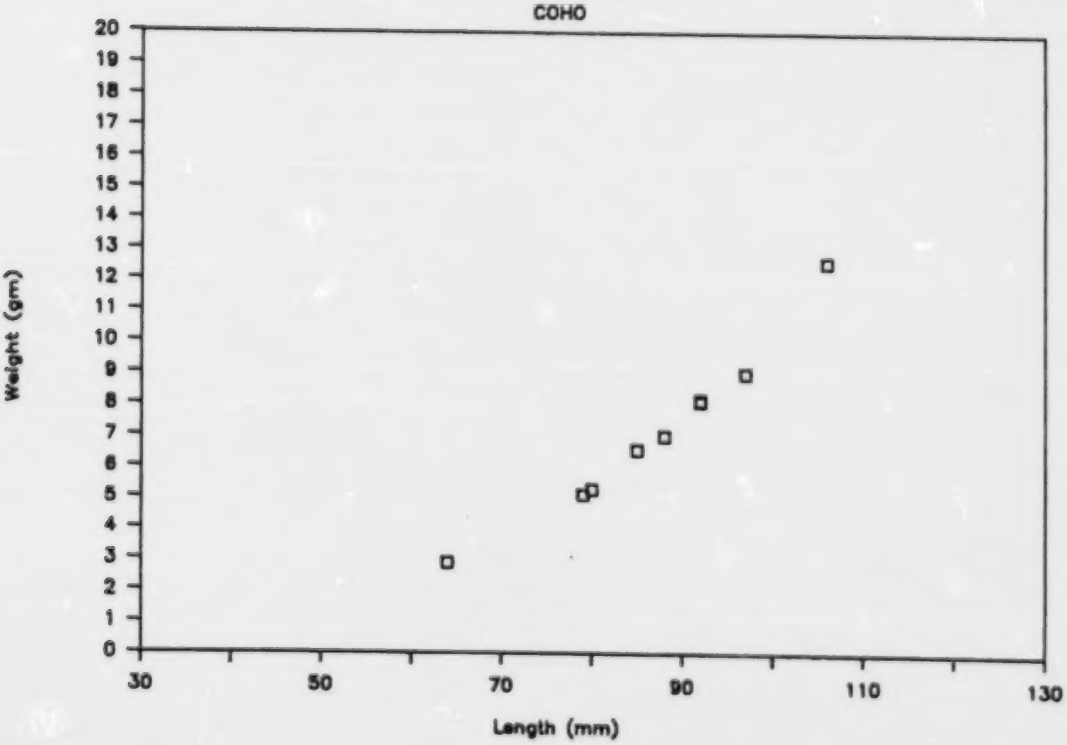
DRAW CREEK

COHO



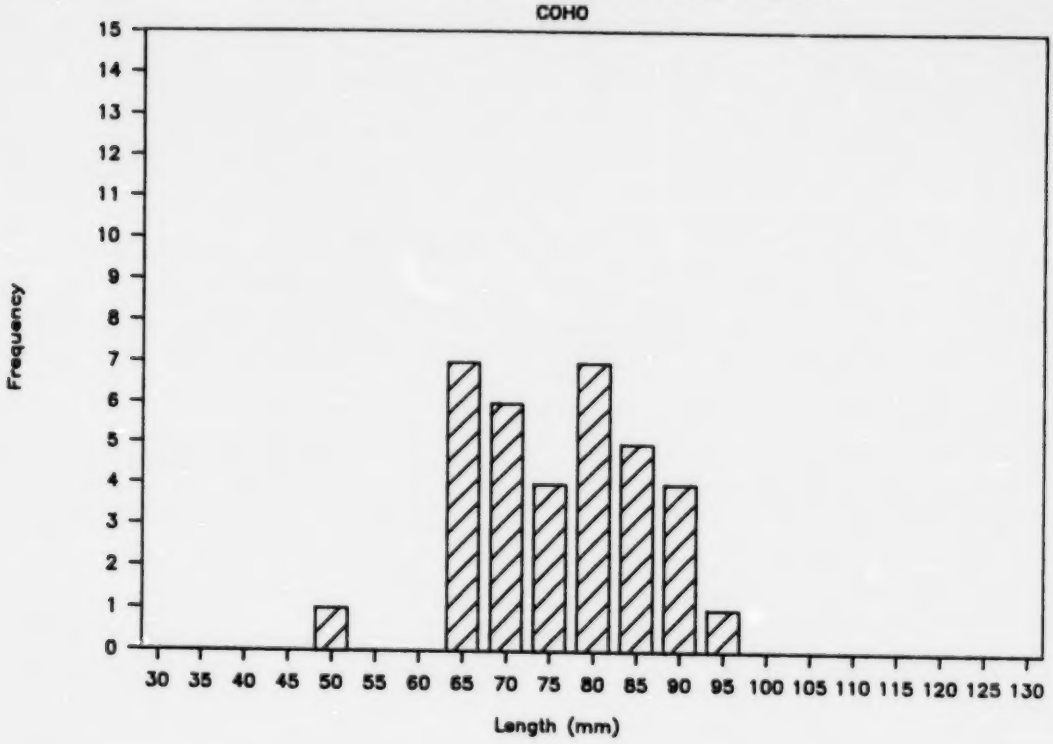
DRAW CREEK

COHO



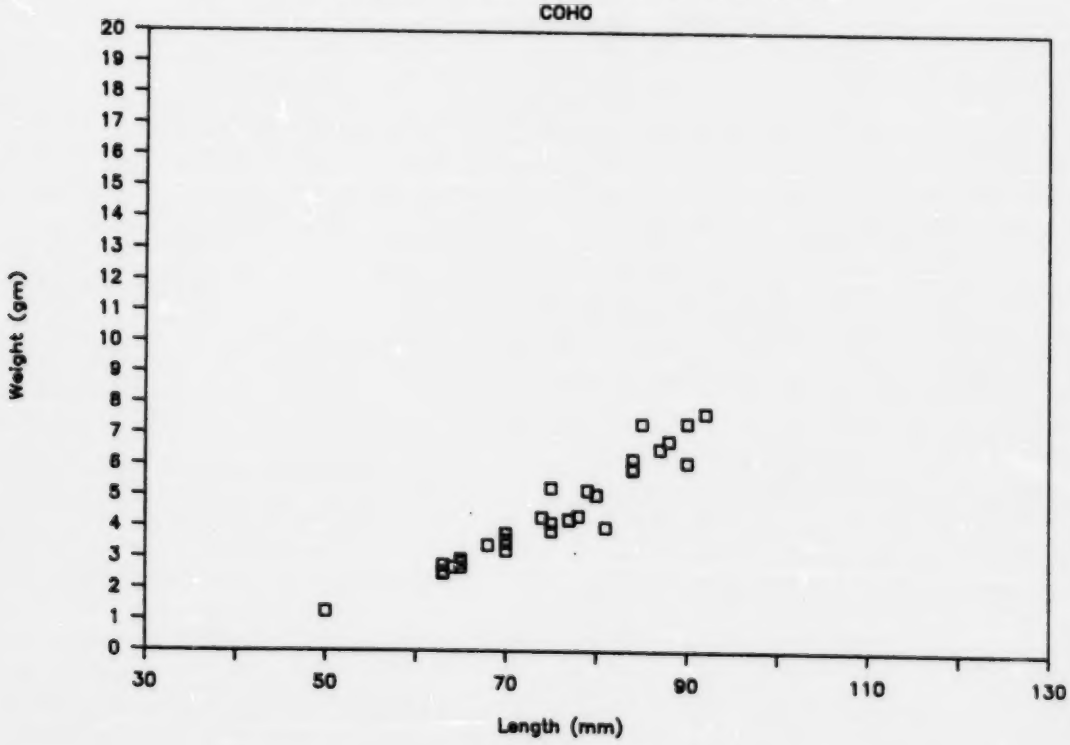
DUTCH HARBOUR CREEK EAST

COHO



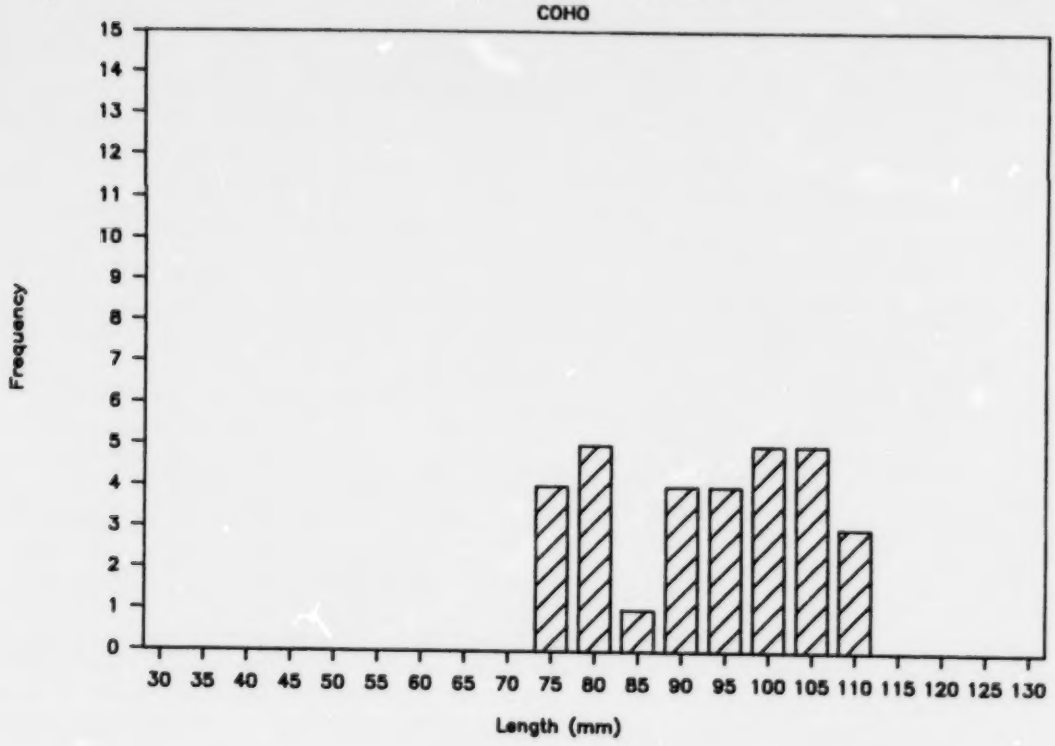
DUTCH HARBOUR CREEK EAST

COHO



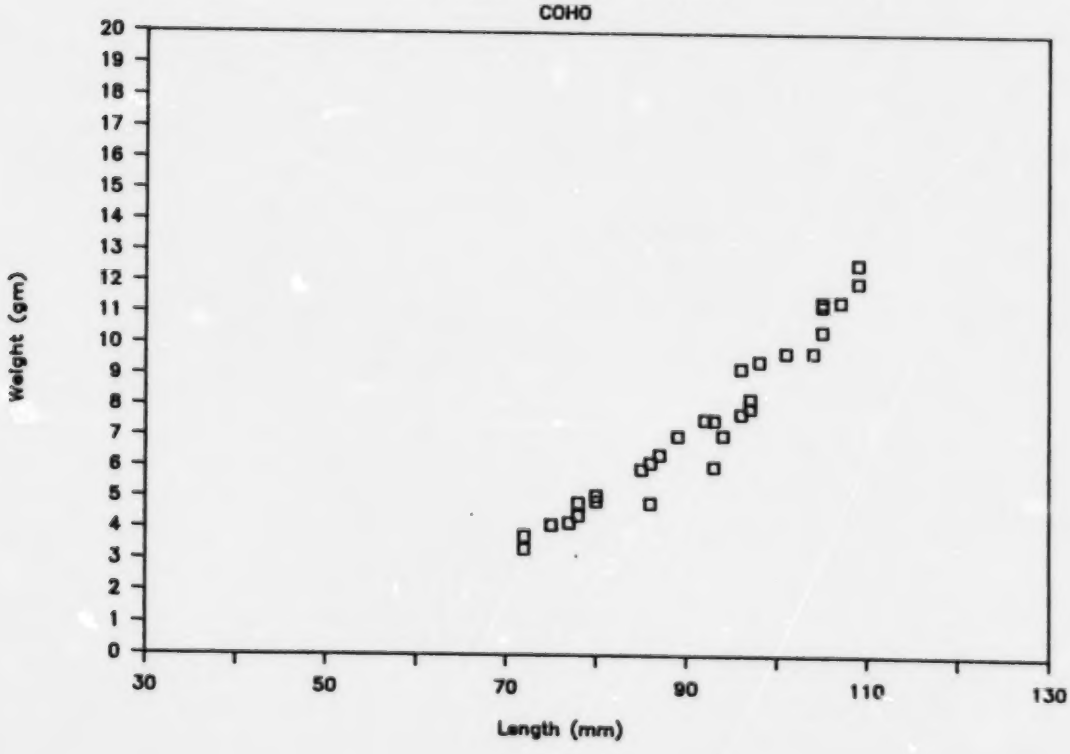
EFFINGHAM RIVER

COHO



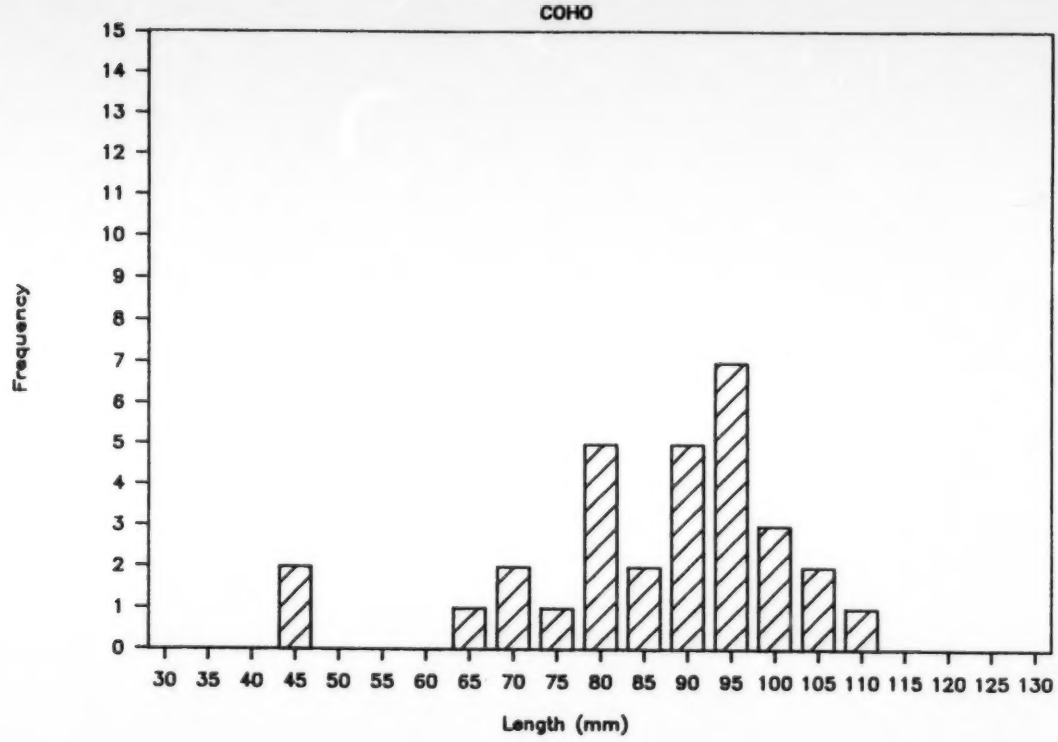
EFFINGHAM RIVER

COHO



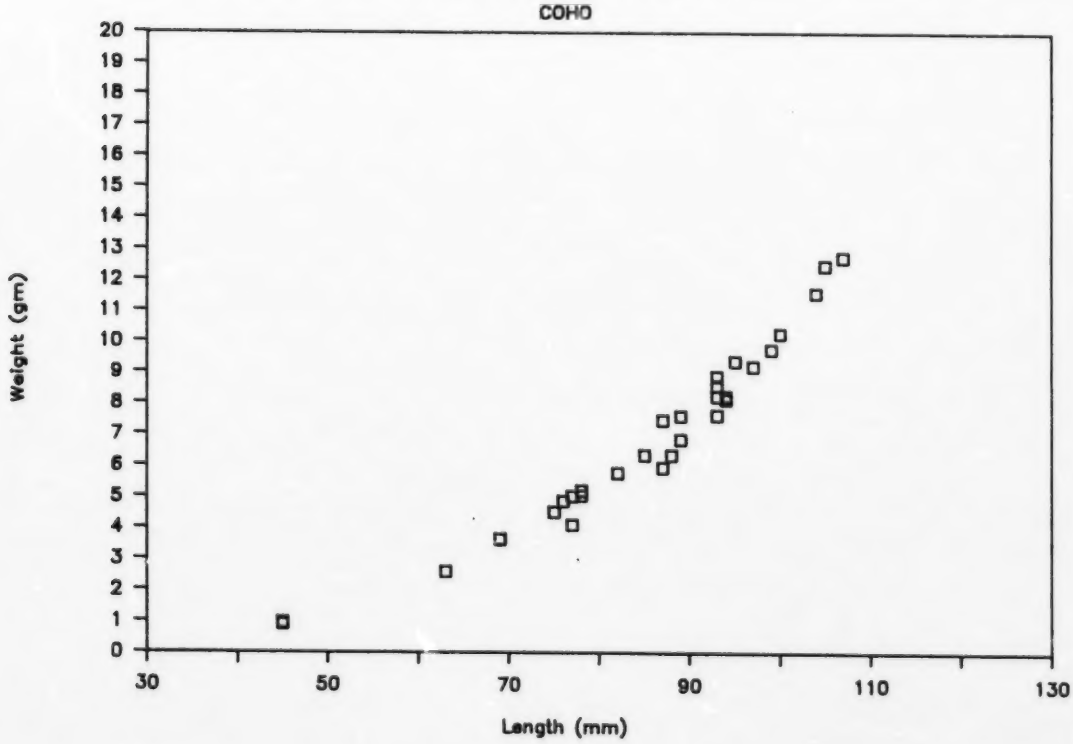
FREDERICK CREEK

COHO



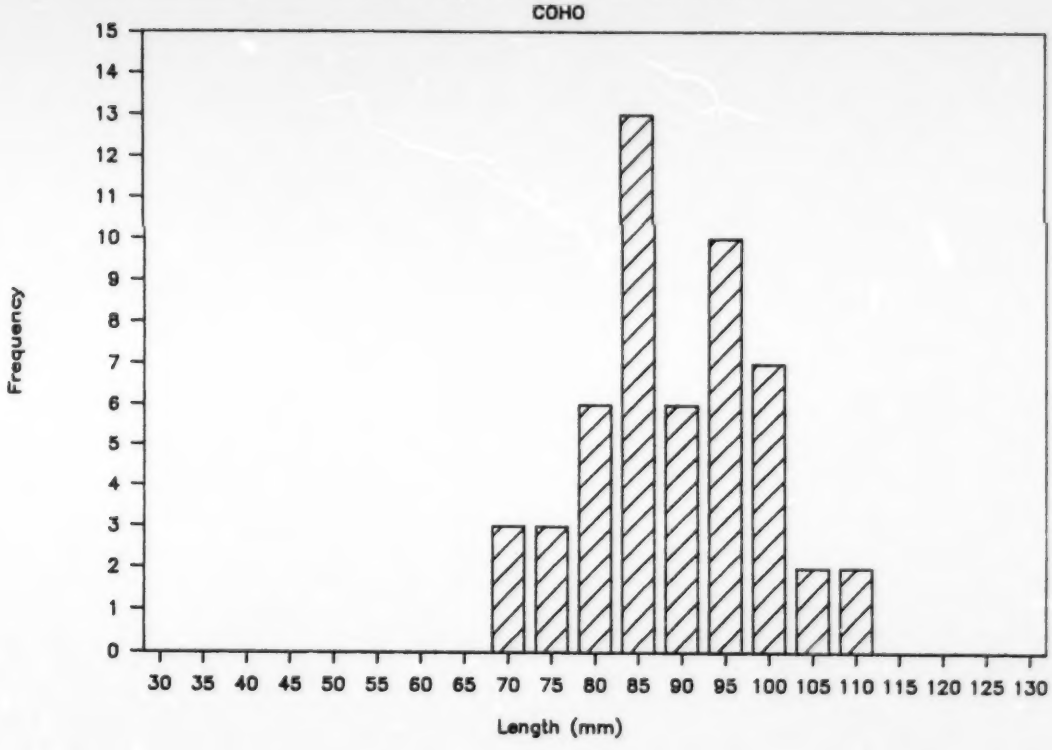
FREDERICK CREEK

COHO



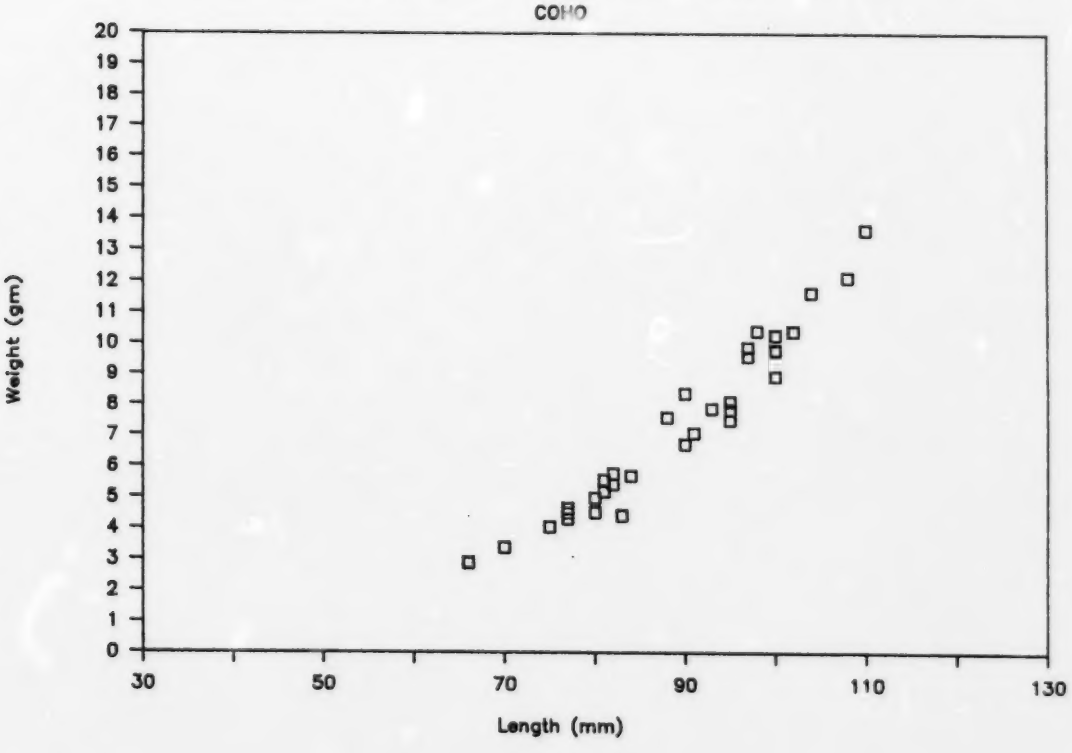
LITTLE MAGGIE RIVER

COHO



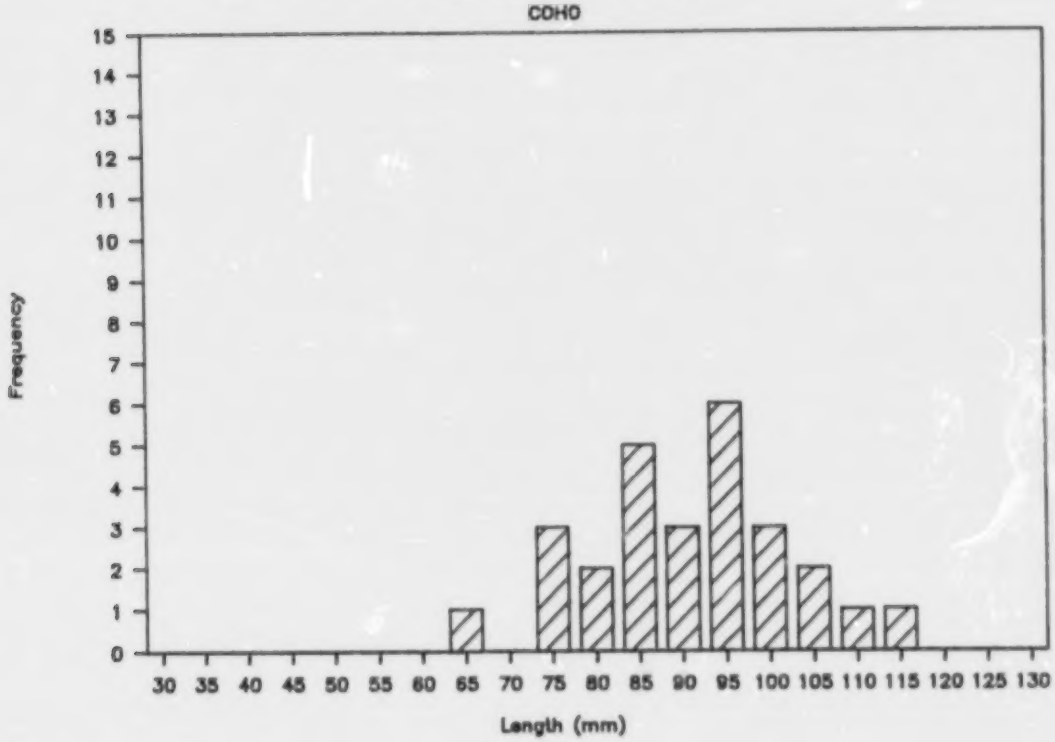
LITTLE MAGGIE RIVER

COHO



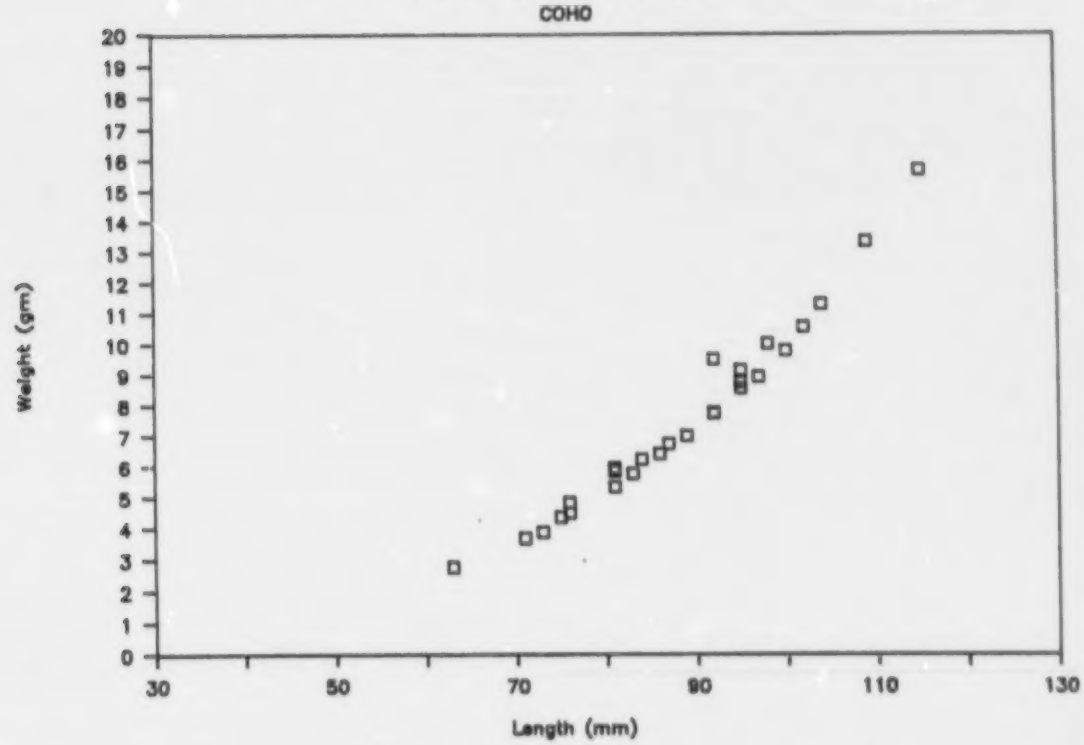
PACHENA RIVER

COHO



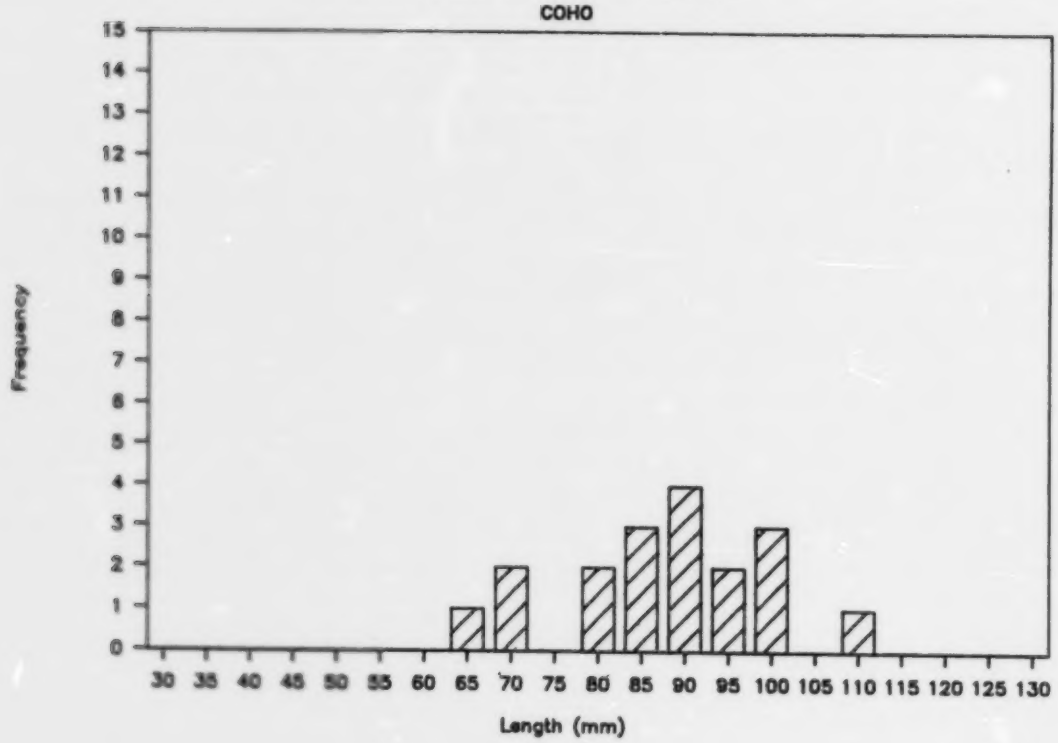
PACHENA RIVER

COHO



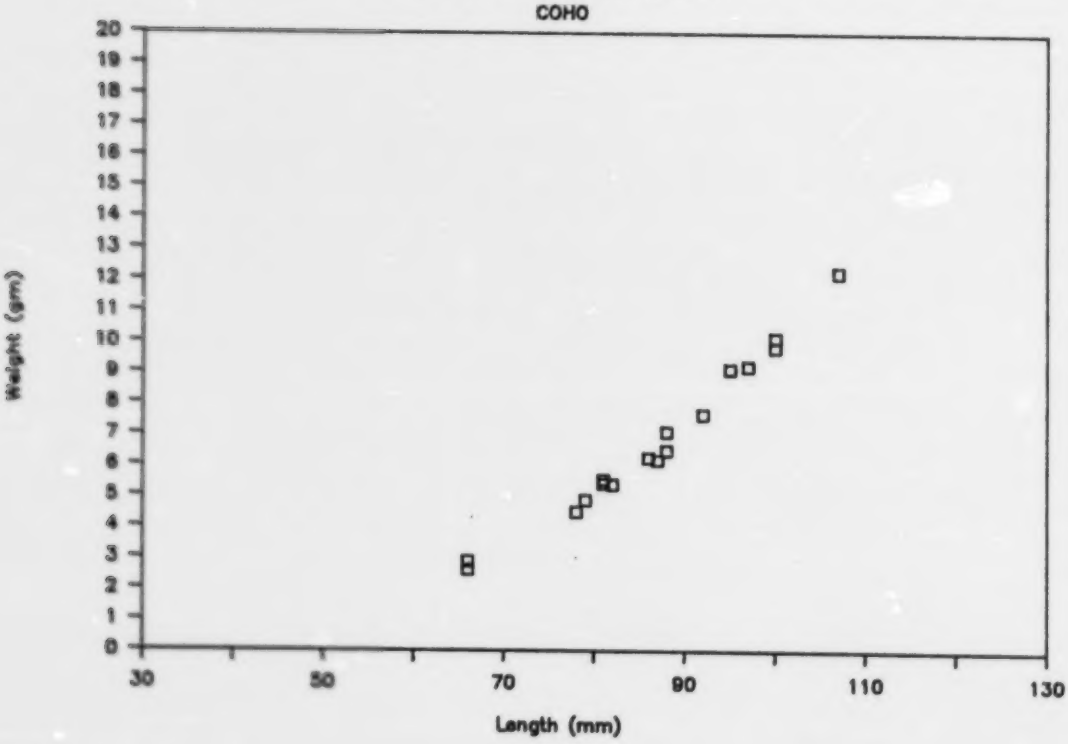
PARADISE CREEK

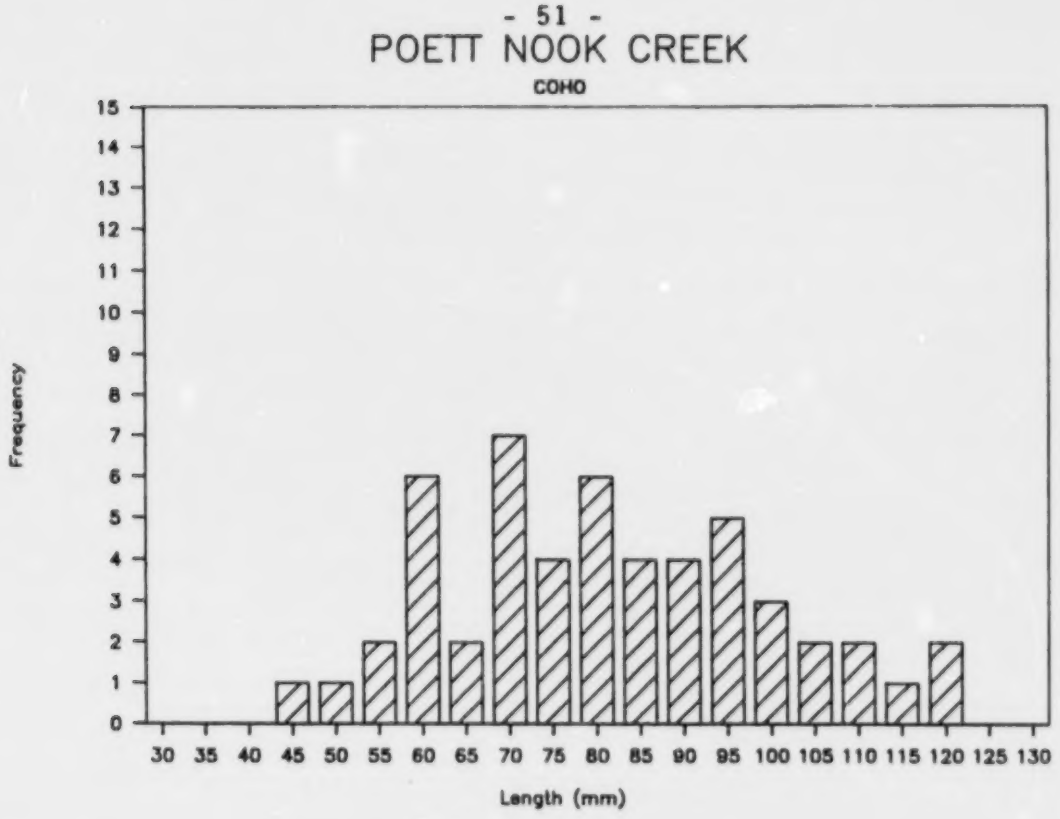
COHO

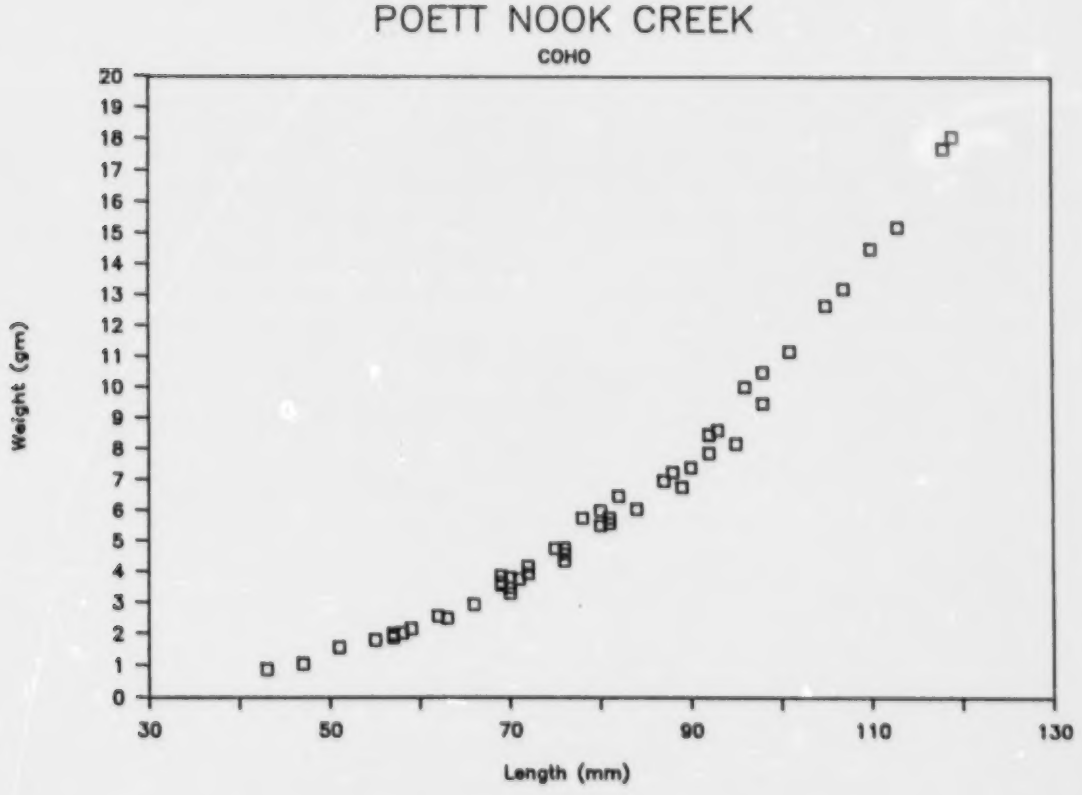


PARADISE CREEK

COHO

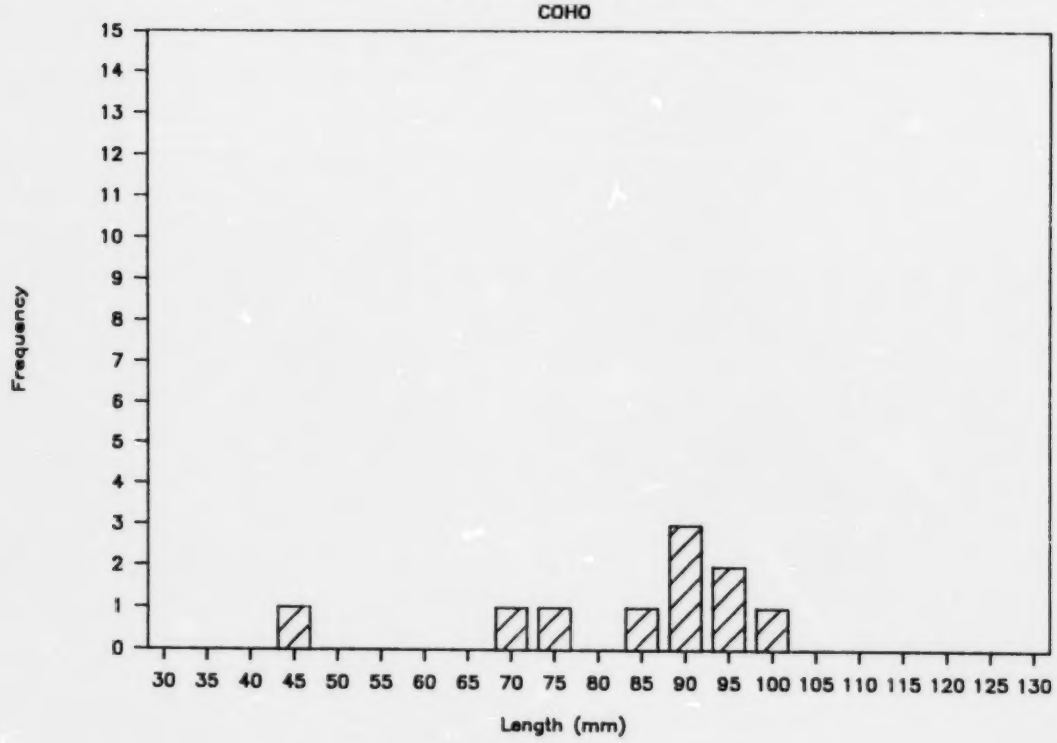



POETT NOOK CREEK
COHO
Frequency
Length (mm)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130


POETT NOOK CREEK
COHO
Weight (gm)
Length (mm)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
30 50 70 90 110 130

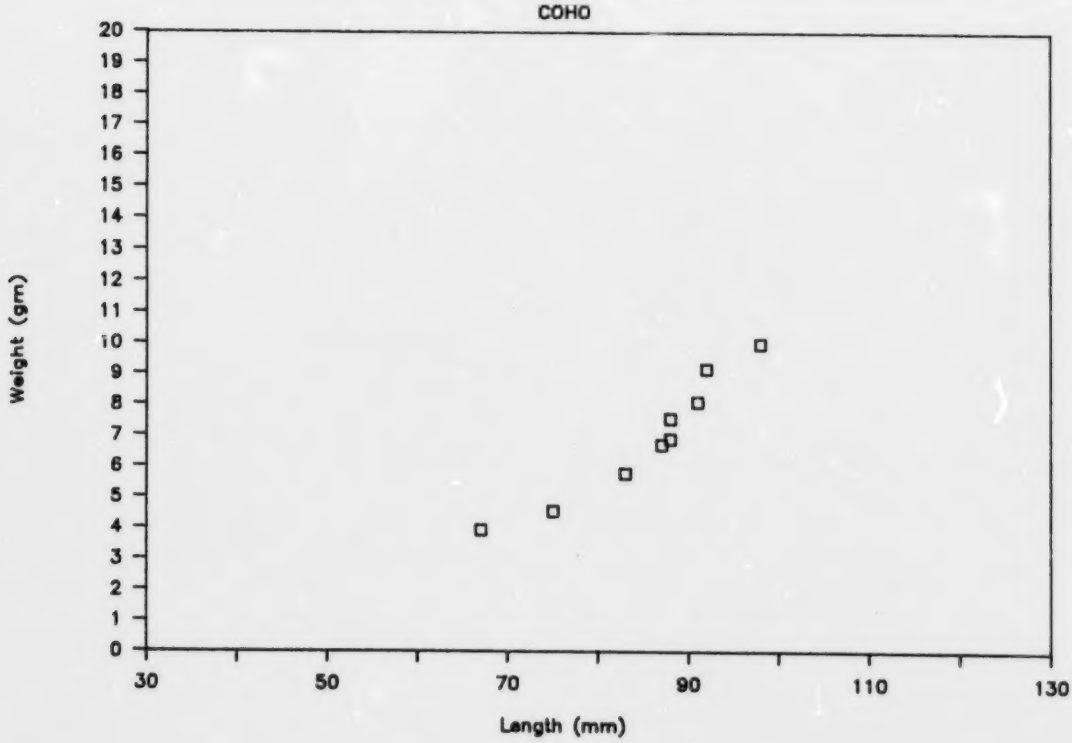
TWO RIVERS EAST

COHO



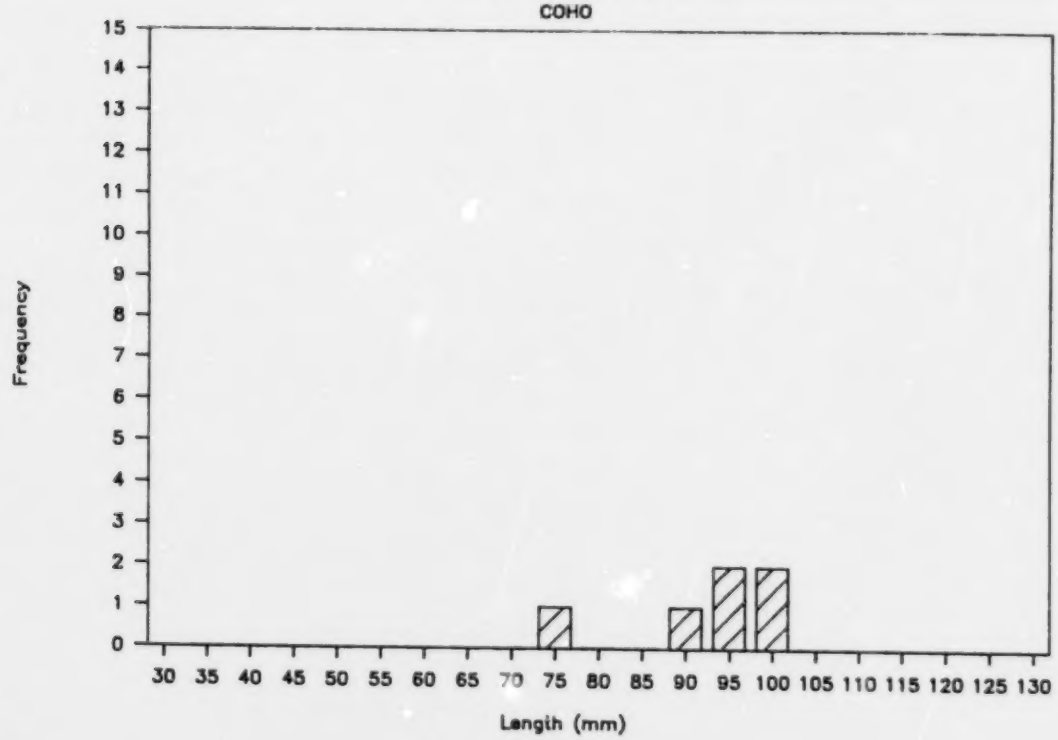
TWO RIVERS EAST

COHO



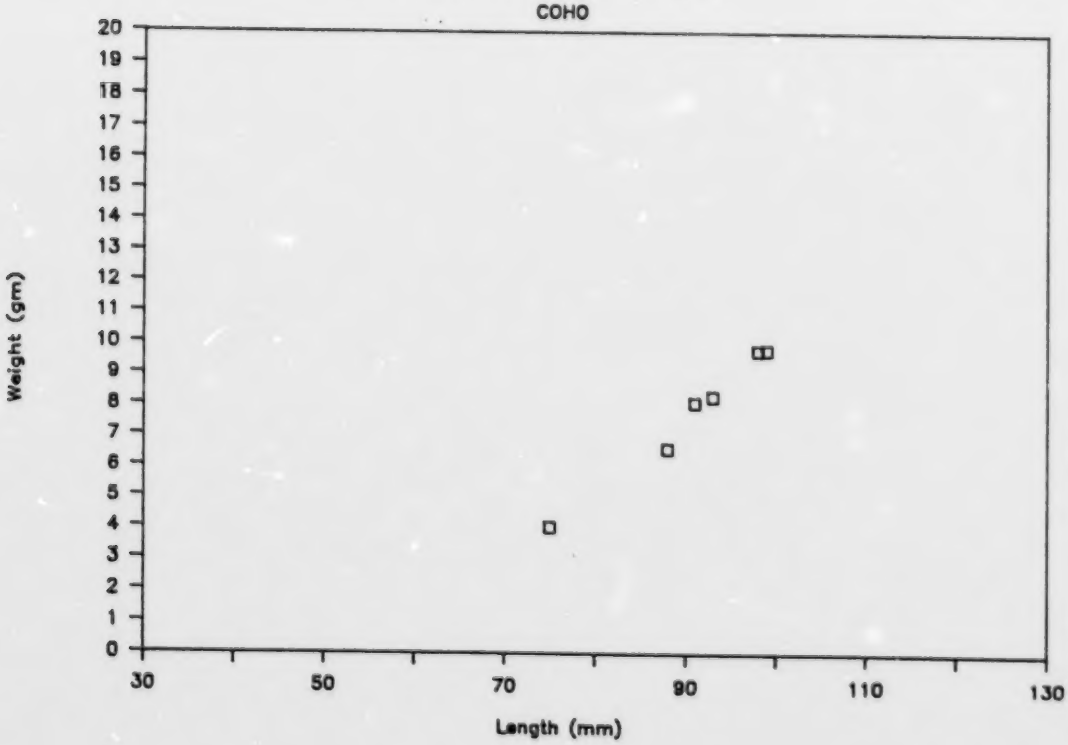
TWO RIVERS WEST

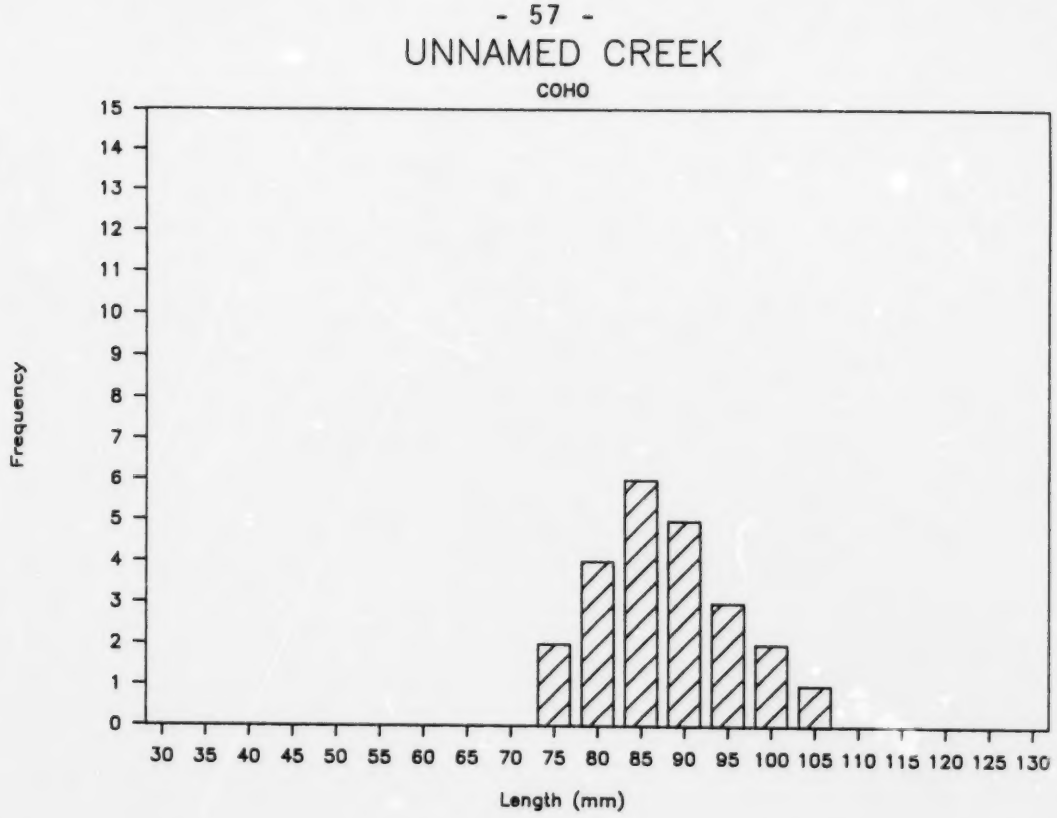
COHO

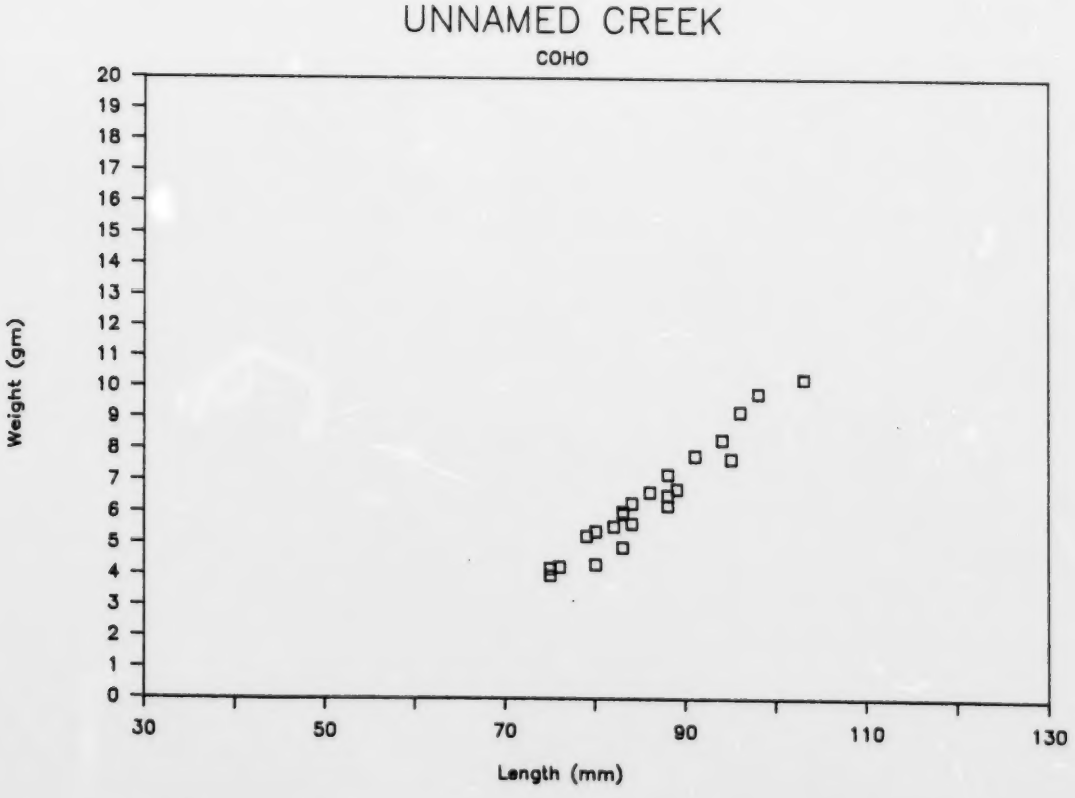


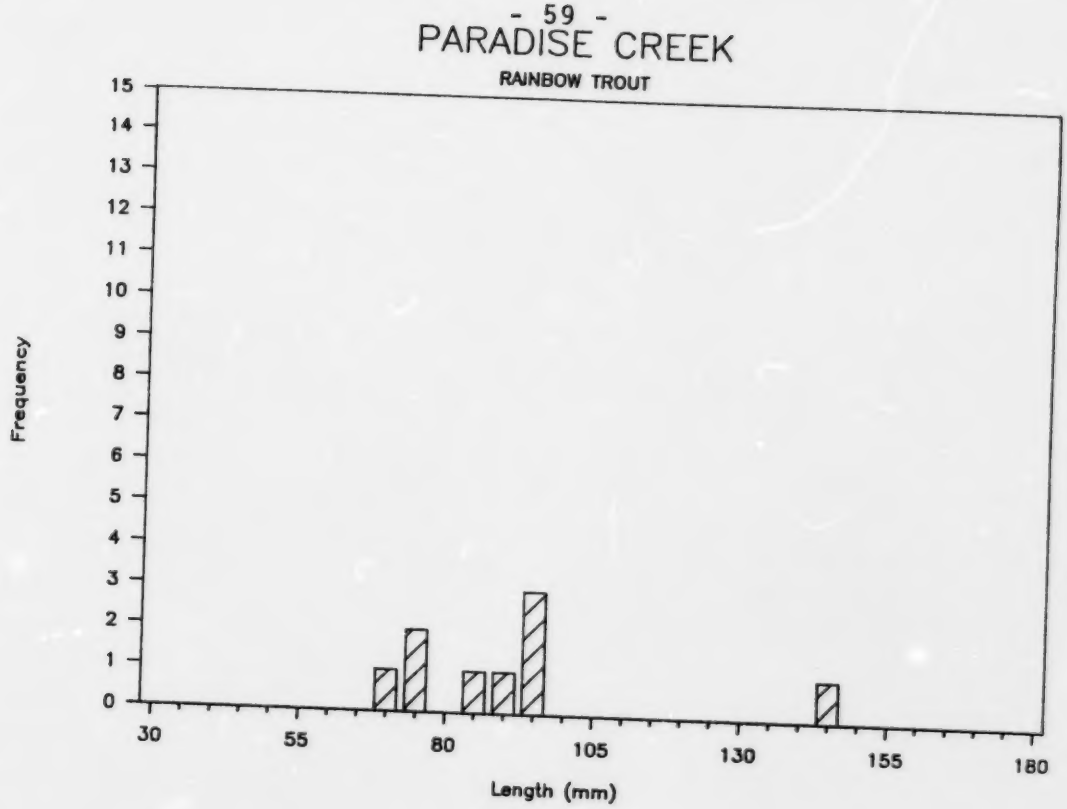
TWO RIVERS WEST

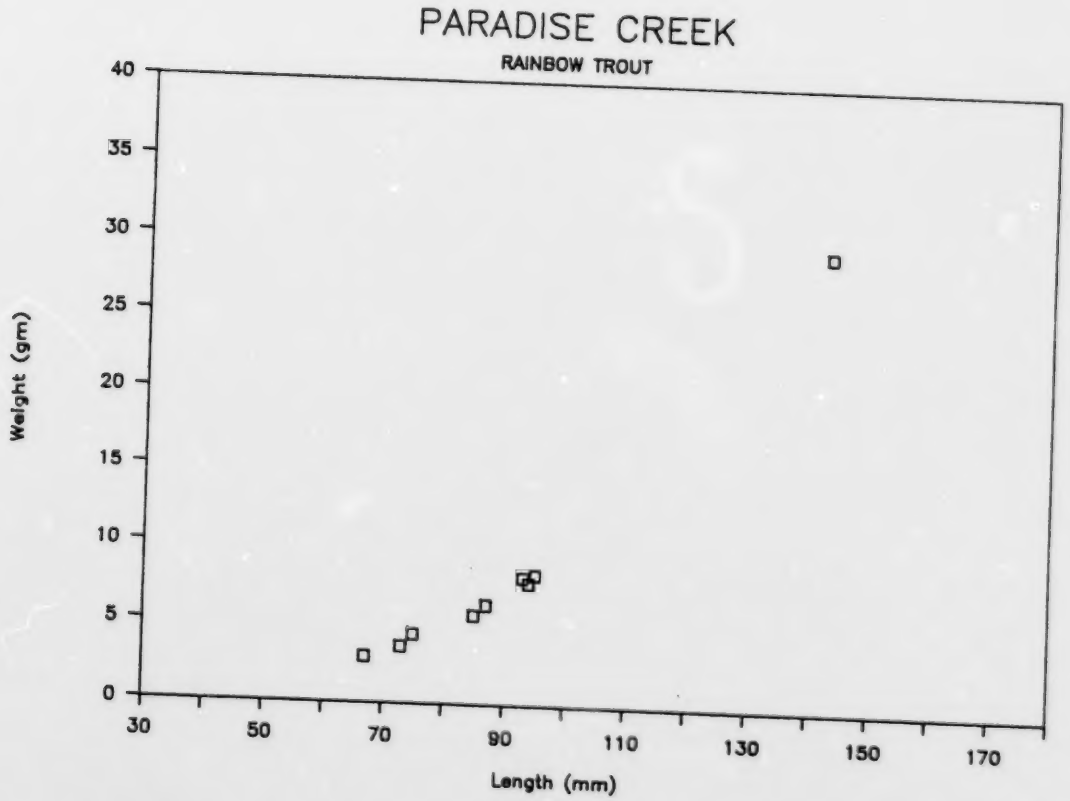
COHO

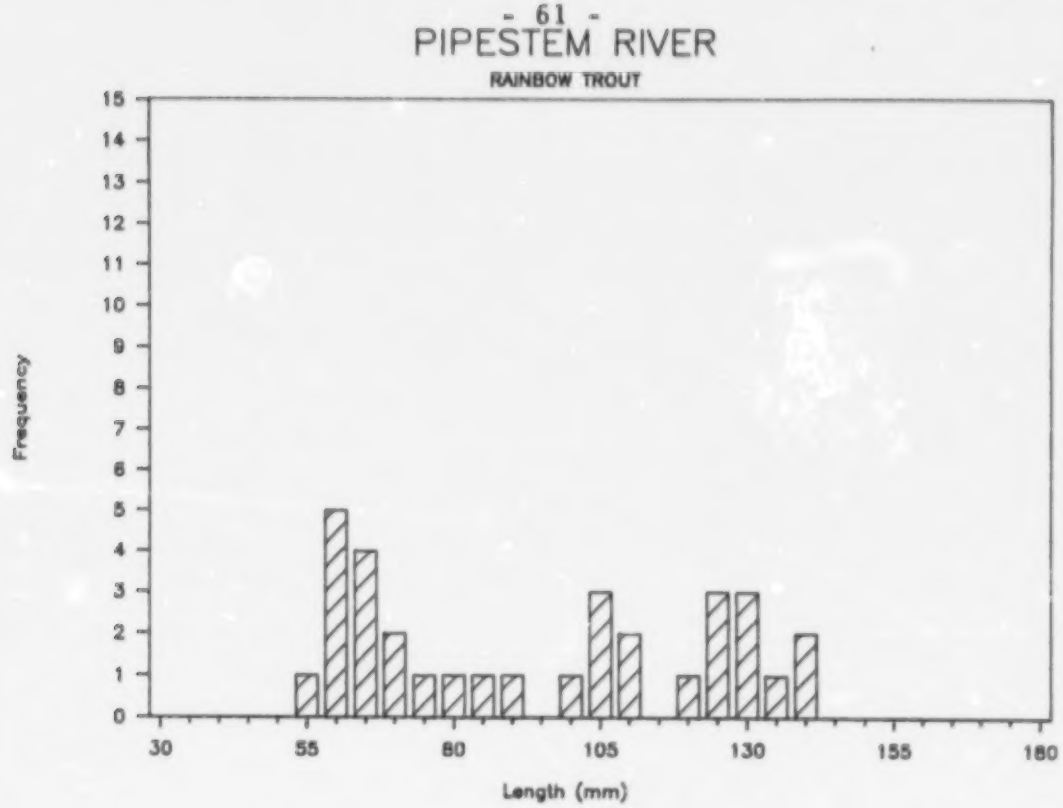


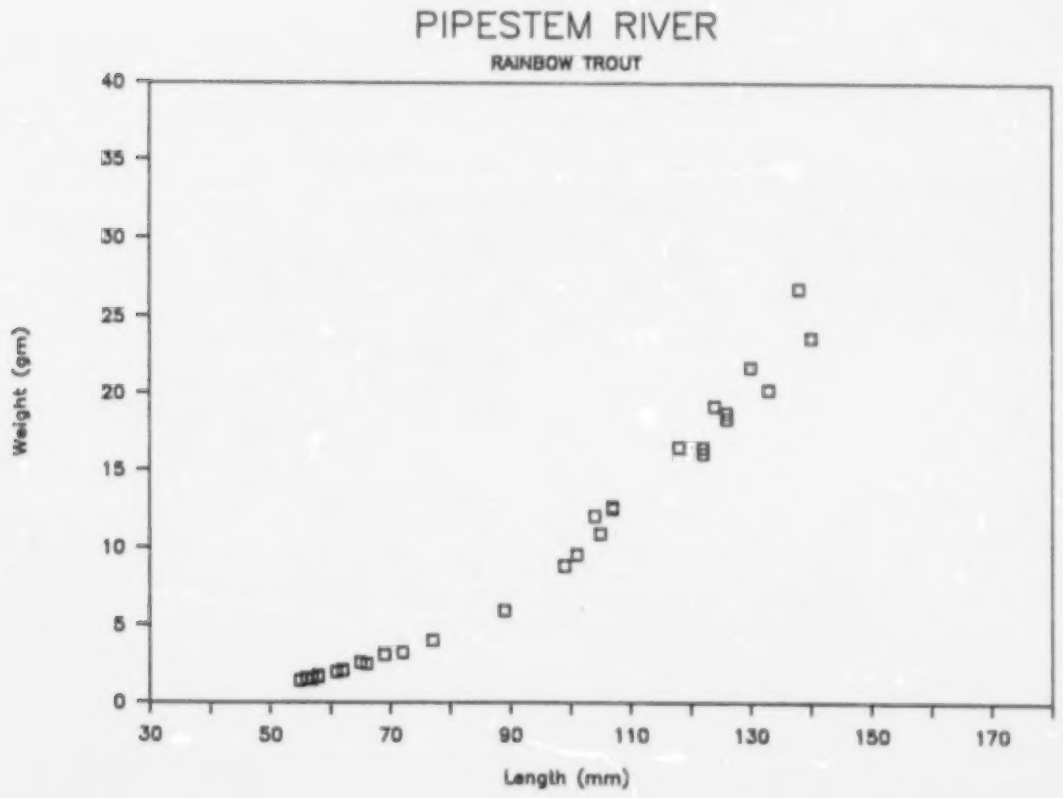

UNNAMED CREEK
COHO
Frequency
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130
Length (mm)


UNNAMED CREEK
COHO
Weight (gm)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
30 50 70 90 110 130
Length (mm)


PARADISE CREEK
RAINBOW TROUT
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
30
55
80
105
130
155
180
Length (mm)


PARADISE CREEK
RAINBOW TROUT
Weight (gm)
0
5
10
15
20
25
30
35
40
30
50
70
90
110
130
150
170
Length (mm)


PIPESTEM RIVER
RAINBOW TROUT
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
30
55
80
105
130
155
180
Length (mm)


PIPESTEM RIVER
RAINBOW TROUT
Weight (gm)
0
5
10
15
20
25
30
35
40
30
50
70
90
110
130
150
170
Length (mm)